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APPARATUS FOR REGISTERING MUSIC.

INSPIRATION is not under one's command. It flies whither it wishes and when it wishes, and it is necessary to seize on the wing. The musician sits at the piano, and his fingers wander over the keys and improvise at the will of his revery. Then, gradually, the images become precise, and, all at once, ideas flow without stint from the brain of the artist. How fortunate would it be were it possible, without delay, to fix all such riches, all such unforeseen findings that are due to the fire of improvization. Still full of excitement, and often exhausted from having entirely abandoned himself to the sacred intoxication, the artist then seats himself before his ruled paper and makes haste; but, with the transport, the dream has fled. The images become confused, the harmonies become extinguished, and the superb flight of the winged genius finds but an unfaithful and laborious translation in this race of black marks over the track of the musical writing. How many have felt discouraged at thus being unable to find such dreams again, or at translating them so imperfectly. Would not the ideal be that the instrument itself should preserve the trace of these harmonies that sing under inspired fingers, and thus provide our musicians with an accommodating and discreet secretary?

For having himself experienced such need of a useful auxiliary, ever ready to do rapid stenographic work, and that should spare him the tiresome work of transcription, a distinguished musician, in conjunction with Mr. A. Rivoire, an inventor, has not despaired of solving the problem. It was a question of constructing a registering apparatus capable of being adapted to all pianos, and that should be capable, too, of faithfully transcribing, at the proper moment, every note touched, with its duration and its place in the harmony. It was necessary, besides, that the musician should not be compelled to learn a new notation; and in order that he might be able to immediately read the written expression of his thought without passing through a laborious deciphering of unusual hieroglyphics, the simplest thing was to preserve the musical staves that were familiar to him.

These have been merely completed by supplementary lines traced beneath in a sufficiently large number to comprise the six octaves of the piano. The lines of this scale are traced by a properly spaced printing wheel upon an endless band of paper, in measure as the latter unwinds with a regular and uniform motion.

This paper passes over a cylinder covered with inked silk such as is found in writing machines. In order to print the notes thereon, and under the action of each key, a special printing wheel descends at the same time that it presses the paper against the silk and marks a line upon the stave at the proper place.

The eye, according to the length of the line, becomes quickly accustomed to perceive the relative duration of the different notes, and the reading is done as rapidly and as easily as if it were a question of ordinary notation.

The white keys correspond to the lines of the stave and to the middle of the interlines. It is at the upper or lower quarter of these interlines that the black keys (sharps and flats) mark their lines, and, in order that these may be still more readily distinguished, a different aspect is given to them by means of two fine parallel lines, while a single heavy line suffices to represent the natural notes.

Finally, in order to facilitate the reading, it is well to divide the musical phrase by measuring bars that are afterward drawn with a pencil, but which are marked during the execution itself by means of two dots printed upon the margins of the paper. It is the musician who forms these by beating measure with his foot upon a pedal.

Such is the result that it was a question of obtaining. Let us see by what means it has been accomplished. Let us say in the first place that the inventor has endeavored to realize a purely mechanical solution of the problem.

The instrument is thus complete without its being necessary to add to it any accessory, as would be the case were recourse had to electricity. And yet it would be impossible not to recognize the facilities offered by this last named agent of modern industry, and we are promised for the next labor exposition a specimen of the same apparatus in which the entire mechanism will be moved by electricity. This solution will be particularly advantageous when it shall become possible, without having recourse to cumbersome piles, to attach the wires to those of the general conductor that now distributes light to a large number of houses. Whatever be the solution adopted, the parts of the registering apparatus are inclosed in a box arranged beneath the keyboard (Fig. 1). It is the magazine cylinder, K, that carries the bobbin of paper. This latter, stretched by the rollers, I and J, passes over the printing cylinder, G, against which, at the proper moment, the type

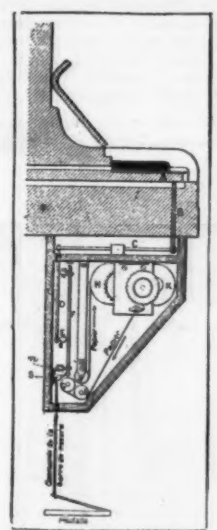


FIG. 1.—MECHANISM OF THE APPARATUS FOR REGISTERING MUSIC.

wheels press it under the action of the corresponding keys.

The printed band continues its course with a speed of 1·25 meters per minute and winds around another magazine cylinder, H. In the present model, the entire system is actuated by a clockwork movement that must be strong enough to preserve a uniform speed,

FIG. 2.—REPRODUCTION OF A PORTION OF THE RUSSIAN HYMN.

despite the abrupt variations of the resistance caused by the friction of the type wheels. Such friction is far from being negligible, in fact, and reaches its maximum when the musician strikes a chord with his ten fingers.

The musical scale that is traced upon the band of paper is the image of the keyboard, but a reduced one, and the printing wheels, as well as the vertical rods that carry them, are necessarily in much closer juxtaposition than are the keys to which they correspond. It was a question, moreover, of rendering each key and its type wheel interdependent, so that they might move together; and therein lay a difficulty, which was ingeniously surmounted as follows:

Upon pressing the key, A, the motion is transmitted to a vertical bar, B, of maple, and, through the intermedium of a lever, C, to a second vertical rod, D, that rises when the key descends. The rod is, in its turn, connected by a short rod with a horizontal shaft, E, that thus turns upon itself by an angle corresponding to the vertical displacement of D.

Let us now suppose that at any point whatever of this shaft, we attach a similar connecting rod that acts upon a new vertical rod, F; then it is clear that such rod will at each instant describe a motion analogous to that of the first, and such motion will be easy to register through the successive contacts of the extremity of this rod with the band of paper arranged to this effect.

This is the whole economy of the system, and it only remains to distribute all these vertical rods and all these horizontal shafts as conveniently as possible for the construction, and to complete the whole by the adjunction of the accessories indispensable. This will be especially the type wheel that marks the place of the measuring bar and that is actuated by a rod or chain attached to one of the pedals of the piano.

The apparatus has been very skillfully constructed by Mr. J. Richard. Being placed beneath the keyboard (Fig. 3) it in no wise interferes with the pianist, who can at will render the two independent or interdependent by acting upon two regulating screws.

In Fig. 1 we give a view of the mechanism. In Fig. 2 we give a specimen of a transcription of the Russian Hymn, showing with what distinctness the reproduction of a morceau may be obtained. In order to reread it by the piano, the inventor has devised a small accessory apparatus which unwinds the printed band automatically before the eyes of the musician.—La Nature.

FIG. 3.—RIVOIRE'S APPARATUS FOR REGISTERING MUSIC.

THE BREWING ACADEMY, CHICAGO.

AT the foot of South Water Street, near the bridge, there is what is called a "model brewery," the only one of its kind in this country. It is operated solely for educational purposes, and belongs to the American Brewing Company, of Chicago, which occupies the three upper stories of the building. The academy has for its object scientific instruction in the art of brewing malt liquors. It is attended by the sons of some of the wealthiest brewers in the United States, who desire to equip themselves with a thorough knowledge of all that pertains to the manufacture of beer. The majority of the students, however, are men who have worked from five to twenty-five years as practical brewers. There are two terms a year, each covering a period of four months, beginning February 1 and September 1. No brewer will be admitted as a student who does not possess a common school education, and he must have had at least three years' experience in a brewery before he can enter the academy.

Though in its infancy, the American Brewing Academy, of Chicago, has already turned out 250 graduates, 160 of whom have secured positions as master brewers at salaries ranging from $1,800 to $5,000 a year. The present fall term has an attendance of forty students.

On the first floor of the academy building there is a suite of offices, a reading room and library. Here, too, are the English class room and a chemical laboratory. On the second floor are the bacteriological laboratory, the pure yeast laboratory, the model bottle shop, the ale and porter brewery, the engine and ice machine room and storage cellar. The fermenting cellar, brewhouse, millhouse, German class room and another large laboratory are on the third floor. The laboratory on the upper floor is being enlarged and undergoing improvements which will make it possible for analyses to be made in the hottest days of summer, which were never before made this side of the Atlantic—the heat preventing. An asphalt floor is being laid in an airtight apartment of the laboratory, in which there will be placed refrigerator pipes to reduce the temperature. From the ceiling a spray of water will fall, producing a perfect atmosphere. Under these conditions the most difficult and important analyses and experiments are possible.

The staff of the institution at present is as follows:

Robert Wahl, Ph.D.,	O. Beyer,
Max Henius, Ph.D.,	A. Siebert,
Frank Arnold,	August Schmidt,
Arvid Nilson,	G. F. Bredemeier,
Louis Henius,	P. Max Kuebrich,
Gaston Thevenot,	John F. Bechtel.

The first two months of each term are devoted to a course of mathematics, chemistry, physics, and microscopy, and the last two months to the theory and practice of brewing, during which time each student assists at twenty brews. For all practical demonstrations the Brewing Academy has at its disposal a complete experimental brewery, equipped with the latest apparatus and machinery.

The lectures delivered during the course treat on the following subjects: Arithmetic, chemistry, and physics (with demonstrations), microscopy and bacteriology, brewing materials, saccharometry and alcoholometry, theory of malting and brewing, machinery (including transmission of power, steam boiler, steam engine, ice machine, pumps, etc.), brewing apparatus and brewing utensils and the routine of brewing.

The practical demonstrations which accompany lectures include practical exercises in the students' chemical laboratory, practical exercises in the microscopical laboratory and exercises in the brewery.

Numerous excursions are made to different breweries in Chicago for the purpose of giving the pupils an opportunity to observe the production of beer on a large scale and become familiar with the working of new apparatus and machinery.

The two classes—German and English—are divided into sets of four, and each day of the last two months of the term, one set of the students is taken to the brewery at 6 o'clock in the morning and there they work under the guidance and instruction of either Dr. Wahl or Dr. Henius until 6 o'clock in the evening. A lecture is delivered the day before on such principal points as will be touched upon concerning the process and experiments to be observed the next day. On the day following the practical exercises a lecture is delivered on the results accomplished the day previous.

What is called "the trick brew" is, perhaps, the most interesting of all. In order to enable the student to detect any defect in the machinery and apparatus or whatever else might endanger the success of the brew, two days of each term are set apart, at intervals, for the purpose of practicing deceptions on the brewers.

Dr. Wahl relates how on one occasion he kept a set of students two hours in a state of amusing perplexity, trying to discover what was preventing a successful brew. He had put some part of the machinery out of order before fire was started in the furnace and it was a physical impossibility for any one else to discover or rather explain what was wrong after the machinery was in motion.

In most cases it is at no little sacrifice that the course of the student brewer is completed. As a rule, he is a man of family, who has worked from five to twenty-five years at his trade at a salary ranging from $60 to $70 a month. He comes from all parts of the Union, and there probably is not a harder or more earnest student in any school of law or medicine in Chicago than he. The average candidate for degree of master of the art of brewing has, by the end of the school term, lost from fifteen to twenty pounds in weight; in fact, he is a changed man in mind and body. He feels compensated, however, for the sacrifice and efforts he has made in the assurance that by securing his degree, a position as master brewer or superintendent is virtually secured, for graduates of the academy are in demand throughout the country.

An instance of the advantage gained by having made a successful course is that of a brewer who came from an Eastern city and who had been earning $20 a week as a workman before he entered the academy. Shortly afterward he graduated from it — eighteen months ago—he secured a position as master brewer at a salary of $3,500 a year. He is a married man, 35 years of age, was a hard student of average ability and had worked as a practical brewer fifteen years. The salary of a master brewer ranges from $1,800 to $6,000 a year.

The growth and success of the American Brewing Academy of Chicago are due to its founders—Robert Wahl, Ph.D., and Max Henius, Ph.D., who ten years ago commenced their professional careers as chemists in the rear of a drug store in 668 West Chicago Avenue. Dr. Henius had acquired a practical knowledge of beer brewing in his native town of Copenhagen, Denmark, where his father owns a large brewery. Dr. Wahl, who was born and reared in Milwaukee, Wis., spent several years in the largest cities of Europe studying modern ideas in the art of brewing. Upon his return the firm adopted the specialty of analyzing for breweries and engaged their services to several Chicago brewing companies. A few years later they concluded that the time was ripe for the establishment of a school in the West similar to the Brewing Academy of New York, which has been in existence since 1885, and was the only institution of its kind in the United States at that time. The latter, however, is a theoretical school only, it having no brewery attached.

Speaking of the academy and the brewing industry, Dr. Henius, who returned from an extended trip through Europe a few weeks ago, said: "It is only natural that Chicago should be in the lead as far as brewing academies are concerned. The remarkable fact is that the United States has been so far behind Europe in the establishment of such schools as it is. Just recently I returned from a trip through the principal cities of Germany, England, Denmark and Ireland (by the way, Guinness' brewery, of Dublin, is the largest in the world), and I visited the principal breweries of the large cities of those countries. I do not hesitate to say, and in fact it is coming to be generally admitted, that America can, and in fact does, produce the best beer in the world. The average production of beer in this country, however, is below that of most European countries in quality, owing to the fact that the standard of knowledge pertaining to the science and art of brewing in this country is inferior. Nature is in our favor as regards soil and climate, but the average brewer is not as competent as he should or might be. As for the American Brewing Academy, of Chicago, it was, until a few months ago, the only school of its kind to which a 'model brewery,' as it is called, was attached. There are twelve brewing academies in Germany.

"With the exception of one recently established, and identically on the same plan as the Chicago academy, they are all connected with breweries which are licensed by the government. The advantages of the 'model brewery' are broader. We can brew whatever kind of beer we desire—put poison in it, or any other ingredient we wish, in order to study results and demonstrate. Not having to supply the market, we are not bound to uniformity as to the kind of beer brewed. One kind can be made to-day and another to-morrow, as the lesson of the day requires. The brewery is a modern plant, and differs from the largest in Chicago in its capacity only. Unlike the schools of Europe, the Chicago academy is not licensed to brew beer for sale, but it was the first in the world to be granted permission by a government to make it for educational purposes. The majority of the students got their fundamental education in Germany, and some of them are graduates of the brewing academies of that country. The English class increases faster than the German class, comparatively speaking."—Chicago Times-Herald.

DRY INSULATOR FOR THE DETECTION OF LEAKAGES OF GAS.

MR. E. BORIAS has recently devised a new apparatus designed for the detection of gas leakages. In order to operate methodically, it is necessary, as well known, to divide the piping into a certain number of isolated sections, the hourly losses of which are determined by an experimental meter. The localization of the leakage is afterward obtained by means of various well-known methods. After the repairs have been made, a new test with the meter determines the results obtained for each section.

The division into sections can be effected with either hydraulic apparatus (Gibault, diaphragm, U or other siphons) or with dry apparatus (bladders, valve cocks, improved insulators, etc.)

Despite their antiquity, hydraulic apparatus are little used, not only because of their usually high price, but also because they create useless as well as dangerous siphons in the pipes, cause losses of pressure prejudicial to the supply of the vicinity, on account of their form or the arrangement of the partitions, and finally, sometimes give rise to choking through naphthaline.

The dry apparatus possess none of these inconveniences, but as an offset, the objection has often been made to them that they are more difficult to maneuver and are not absolutely tight. In the Borias insulator an endeavor has been made to preserve all the good qualities, and at the same time, to render it easy to maneuver at the level of the ground, and make it capable of furnishing a perfectly tight joint.

It consists essentially of a sphere, A, cast in a piece with short lengths of pipe (Figs. 1 to 4), and surmounted by a pipe, D, closed near the surface of the ground by a disk, a, which rests upon a ring of rubber or greased leather that prevents adhesion. This disk is held tightly in place by two jointed bolts, L, provided with thumb nuts. The tubes, C, are designed for tests with the experimental meter. They permit of a communication between two conduits not submitted to a search for leakages.

All the tubes of the apparatus enter a cast iron box of small size closed by a plate, J, at the level of the road bed.

The insulator is completed by an independent tube, G, that carries a rubber plug, I, and is provided above with a cock, G. At the lower part of this tube is fixed a bag made of a superior quality of rubber, and of a diameter proportionate to the sphere, A.

The insulator is put in the place selected after the proper length of conduit has been cut out. The coupling boxes, B, which serve to connect the insulator with the conduit are of the "Universal" type, with rubber joint and counter flanges. They afford a rapid and perfect assembling.

In order to use the apparatus, the disk, a, is removed, and the rubber bag is introduced into the pipe, D, and pushed downward into the sphere, A, the pipe, D, meanwhile, being kept closed by the sliding plug, I. After the bag is in place, it is moderately inflated so as to cause it to adapt itself to the sides of the apparatus and afford a hermetical joint. After this, the couplings, b, for the tubes, F, that run to the meter, are substituted for the iron screw plugs, E, that close the tubes, C. Before proceeding to the tests, the joint is verified. To this effect the isolated section is connected with the entrance of the meter, the exit of which remains free. No waste of gas ought to be found. Were it otherwise, the bag would be inflated a little more yet. In the beginning, one has rather a tendency to inflate the bag too much. This causes it to project into the pipes and obstruct the intake apertures. It is then necessary to empty it.

All that precedes supposes the apparatus to be placed upon a straight pipe; but the sphere can also be applied just as well to a bifurcation. There results from this a possibility of making apparatus with two, three, and four branches, and of thus reducing the number of them in the division of a given system of pipes into sections.—Revue Industrielle.

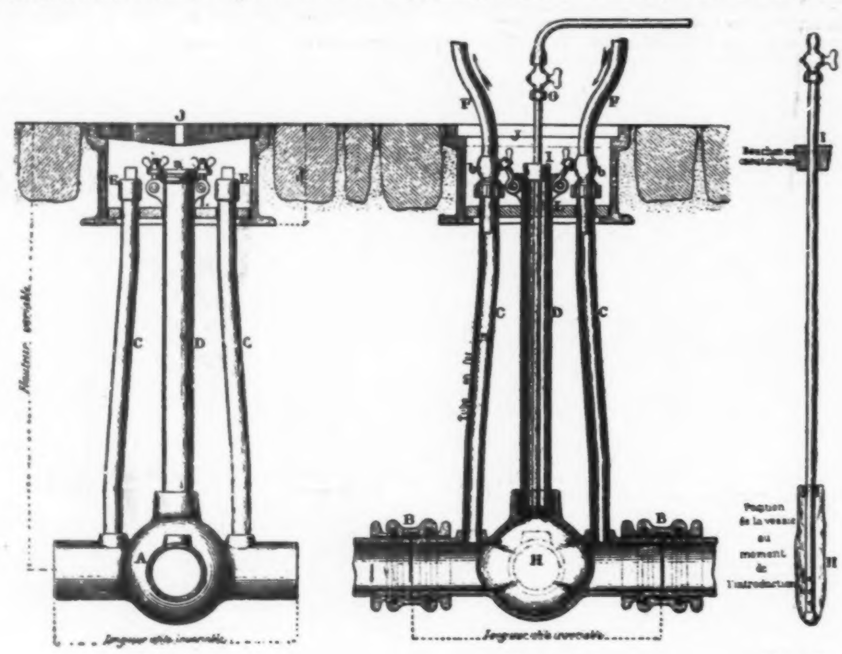


FIG. 1. FIG. 2. FIG. 5.

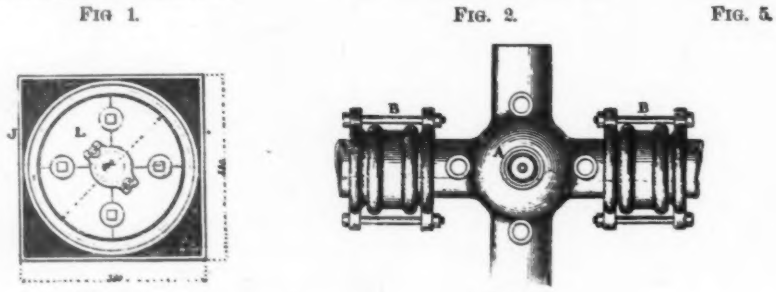


FIG. 3. FIG. 4.

FIG. 1.—Apparatus Mounted. FIG. 2.—Apparatus under Experiment. FIG. 3.—Plan of Box. FIG. 4.—Plan of a Branch. FIG. 5.—Tube and Rubber Bag.

PRACTICAL ADVICE FOR THE DIRECT PHOTOGRAPHING OF COLORS ACCORDING TO THE LIPPMANN METHOD.

VERY few amateurs have tried to put into practice the ingenious differential method of directly reproducing colors by photography, pointed out in 1891 by the learned Professor Lippmann. This, however, is not for the want of apparatus, since any sort of camera may be used, it merely being necessary to adapt thereto a mercury frame, of which there are numerous models, one more ingenious than the other. But, although the number of models is large, we might easily count those that are used. To what is this due? Not to the difficulty of putting the method in practice, but to the fact that it is necessary to use peculiar plates with continuous film and without grain, and to the fact that such plates are not found in the market. The operator is compelled to prepare them for himself just as he did in the time of wet collodion. Such preparation, although quite delicate, is, nevertheless, not impracticable. We take as a witness Mr. Coutamine, one of the most skillful members of the Photographic Society of Lille, and one of those rare amateurs who has had the courage to attack the peripeteia of this delicate experiment. It is useless to add that his efforts have been crowned with success. So we have asked him to give us some data as to the practice

of the process in order to communicate them to our readers.

Let us recall the fact that, as a substratum, we may employ collodion, albumen or gelatine, but on condition that they be sensitized in a bath. The preparation of collodion plates is described in detail in all works, and we shall be content to say that care should be taken to orthochromatize them. It is albumen plates that have proved most satisfactory to Mr. Coutamine, who advises that they be prepared according to the following method:

Take the white of an egg and put it into a cylindrical test glass with a foot. With a wooden disk of a diameter nearly equal to that of the test glass, and provided with a long handle, churn the white of the egg until a very thick froth is obtained. Then let it rest for a few hours and filter it through wadding which has been freed from grease by boiling it in a dilute solution of potash. After filtering it, add to the white of the egg four drops of a cold saturated solution of cyanide dissolved in alcohol and two drops of a solution of erythrosine. After thoroughly washing the test glass, put the filtered liquid into it and add thereto iodide of potassium reddened by the following process: Put into a bottle a few scales of iodine and some crystals of iodide of potassium, which, at the end of a few hours, will become red. Then, selecting the most deeply colored of these, put them into a drop counter bottle so that they shall occupy a third of its height, and finish by filling it with distilled water. In this way there will be obtained a saturated liquid, six drops of which are to be put into the test glass containing the albumen.

After a churning and a rest of three hours in a cool and aerated cellar, the whole is to be filtered, and the operation to be repeated for two or three days. Then the whole is allowed to rest again for several days.

Then, by means of a tournette, two thin films are spread over a glass plate, which is treated with the following bath of aceto-nitrate of silver:

Water	100
Crystallized nitrate of silver	10
Pure acetic acid	10

In this way are prepared four baths that are left exposed to the light. Mr. Coutamine has remarked that the more the baths have been used the better they are. The four baths are used successively. In measure as their proportion of silver diminishes, a new bath is added so as to have one containing a sensibly constant quantity of silver.

The albumenized plates will keep for a long time, provided they are sensitized only in measure as they are needed. They must be used within three or four days according to their sensitization.

It is well to spread the sensitive film over plates polished on one side, since the film is so transparent that it would otherwise be difficult to recognize the side covered with it. It may be dried in a box containing a large quantity of chloride of calcium.

Plates thus prepared have quite a slight sensitiveness, which may be increased by modifying the proportions of the bromides and iodides and in incorporating with the film mucilaginous substances that give it more permeability. Such is the process of Mr. G. Sella, which consists in pouring the mixture:

Water	4
Gum sirup of the codex	5
Iodide of potassium	1
Pure iodine	0·2
Bromide of potassium	0·2

into 100 grammes of albumen and finishing as in the preceding process.

Finally, there may also be employed with advantage the albumenized collodion process, consisting in collodionizing the previously albumenized plate with the following mixture:

Ether	400
Alcohol	400
Guncotton	8
Iodide of cadmium	4
Iodide of ammonium	4
Bromide of ammonium	2

to which care has been taken to add a few drops of alcoholic solutions of orthochromatic substances and to immerse it a few minutes afterward in the following bath, which should be acid:

Water	100
Nitrate of silver	7
Acetic acid	3 to 4

After being taken from this bath, the plate should be drained and washed with distilled water when its opacity ceases to increase. Then it is to be drained anew and the following mixture be poured over its surface:

Albumen	100
Iodide of ammonium	1
Bromide of ammonium	0·25
Dextrine	3 to 4

After these operations, which may be performed in a feeble white light, plates are obtained that keep well, and that it suffices at the moment of using to sensitize through an immersion of about thirty seconds in the following bath:

Water	100
Nitrate of silver	7
Crystallizable acetic acid	7

The sensitized and isochromatized plate may, as soon as it is dry, be exposed in the mercury frame in the camera.

Any objective may be employed, but, particularly as regards the production of the spectrum, it is well to make a selection. According to Mr. Coutamine, the best consists in one formed of spar and quartz, for certain objectives, especially those that are very rapid, do not permit all the rays of the spectrum to pass.

Mr. Coutamine also makes use, with success, of an objective constructed by Chevalier forty years ago. According to him, if manufacturers could succeed in supplying special objectives that allowed the red rays to pass and arrested the yellow and especially the blue ones, they would render a service to those who are making researches with the Lippmann process.

In the meanwhile he employs a cell, made of glass, with parallel faces, into which he puts a colored liquid composed of helianthine and primuline. He has also succeeded in putting films of colored albumen upon one of the surfaces of the plate.

For red, green and blue radiations, Mr. Lippmann at first made the exposure in three periods.

(1) During the entire exposure of the red, he interposed a small cell of glass, with perfectly parallel faces, full of a solution of red helianthine, allowing of the passage of the red radiations only and completely absorbing the blue, yellow and violet ones.

(2) When the red had been sufficiently exposed, he replaced the helianthine by a solution of bichromate of potassium, allowing of the passage of only the green and red and absorbing all the other radiations. Under such circumstances, the part of the plate corresponding to green was impressed at leisure and the red continued to be exposed during this time.

(3) Finally, in order to obtain blue and violet, the objective was uncovered for a few seconds without the interposition of any cell.

The screens to be employed depend upon the manner in which the plate has been orthochromatized. The same is the case with the time of exposure. Thus, we have seen that a single picric acid screen now suffices the Lumiere brothers. The time of exposure depends also upon the sensitized film employed. With albumen it is very long.

The development that seems most suitable is that with pyrogallol. The following is the developer used by the Lumiere brothers:

Sol. 1.	Water	100
	Pyrogallic acid	1
Sol. 2.	Water	100
	Bromide of potassium	10
Sol. 3.	Caustic ammonia (D=0·96 at 18°).	

In order to develop, there is taken:

Sol. 1	10
Sol. 2	15
Sol. 3	5
Water	70

The quantity of ammonia is of very great importance, for quite feeble variations in the above proportions quickly diminish the brilliancy of the colors.

After development, the plate is washed, and then fixed by an immersion of from ten to fifteen seconds in a 5 per cent. solution of cyanide of potassium, and finally dried.

A developer consisting of an ammoniacal solution of cuprous chloride has likewise given good results, but its very great instability has caused us to abandon it.

For developing, Mr. Coutamine uses a warm bath composed of from 3 to 4 grammes of carbonate of ammonia dissolved in from 50 to 60 cubic centimeters of water and from 7 to 8 drops of a ten per cent. solution of bromide of potassium. He immerses the plate in this and adds to the bath pyrogallic acid, a little at a time, until the plate, seen by transparency, is colored and the image very apparent. It sometimes requires more than twenty minutes for the operation.

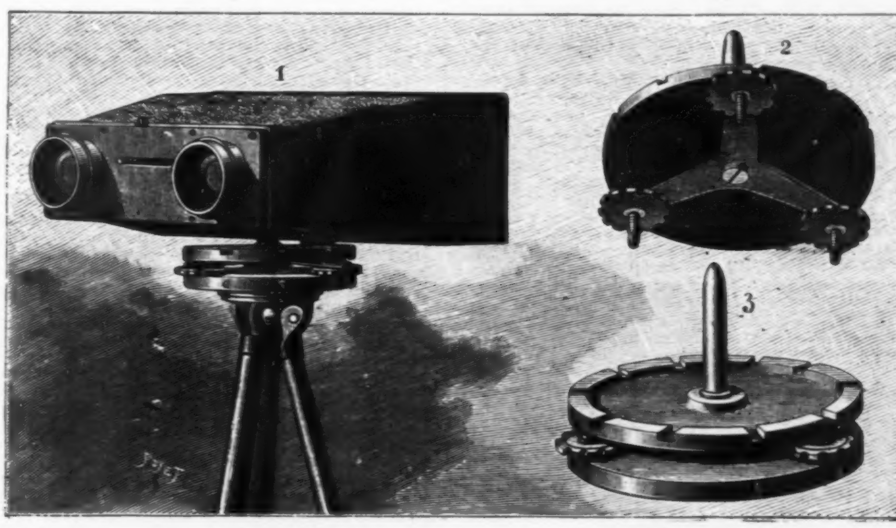
As for fixing, the usual baths may be used, especially the solution of hyposulphite of sodium of 150 grammes to a liter of water. The fixing is very rapid on account of the thinness of the sensitized film.

The bichloride of mercury images may be reinforced in order to increase their brilliancy. The Messrs. Lumiere further increase the latter by a new development. The colors begin to appear only upon drying. They are best seen by diffused light.

The few details that we have just given will, we hope, show our readers that the putting in practice of the celebrated experiment of Mr. Lippmann does not offer so much difficulty as might be thought and that this statement will induce them to make experiments.—La Science Francaise.

THE PANORAMIC PHOTO-FIELD GLASS.

MR. MASCART, a member of the Institute, showed the Academy of Sciences a few months ago, in the name of Mr. Carpentier, who, as well known, invented the photo-field glass that bears his name, how, with this little apparatus, it is possible to obtain magnificent panoramic views. How difficult it has been up to the present to take a half circumference of the horizon photographically, without large special apparatus, is well known. Nothing is simpler now, with the apparatus above mentioned. The negatives of the apparatus measure 45 mm. by 6 cm. We have seen reproductions on glass of from 24 to 30 cm. of wonderful delicacy. The photographs in question were taken in the Alps by Mr. J. Vallot, to whom we owe the first observatory established near the summit of Mont Blanc. Aside from the interest attached to each of them, they offer the peculiarity of forming true panoramas through their union in series. Such a condition has been realized by the addition to the field glass of a small support specially designed to this effect and represented in the accompanying engraving.



THE PANORAMIC PHOTO-FIELD GLASS.

1. The apparatus. 2. The support. 3. Details of the axis of rotation.

This accessory, which may be adapted to any photographic stand whatever, consists of a conical pivot fixed to the center of a small horizontal disk, 6 cm. in diameter, whose circumference is provided with a dozen equidistant notches. As this disk is provided with three leveling screws, it is easy, with a pocket level, to obtain an exact horizontality of it, and, at the same time, a verticality of the pivot. The body of the photo-field glass, on another hand, is provided with an aperture for the reception of the pivot upon which it is to revolve. The field glass is placed upon this without the need of being otherwise fixed, and is separated from it without any effort when it is a question of effecting the change of plate by trick. Thus mounted, it is capable of revolving horizontally. Thanks to a metal pawl with which it is provided, and which enters the notches of the disk, it can be placed successively in twelve distinct directions regularly distributed in a circumference of the horizon, and thus take a complete panorama. A few minutes suffice for the entire operation, and such rapidity of maneuvering is advantageous, in the sense that it assures the different negatives great homogeneousness of illumination.

Mr. Vallot's negatives were taken in August last, in clear weather, upon Lumiere orthochromatic plates, through a glass of a dark yellow color with parallel surfaces that lengthened the time of exposure in the ratio of 15 to 1. The objective, a Zeiss astigmatic of 85 mm. focal distace, was diaphragmed to about 1-40. The developing was done two months after the exposure of the plates with a feeble and slow developer. One of the series was taken from the top of the Brevant, at an altitude of 2,525 meters. The exposure, determined by means of preliminary experiments, was 10 seconds. This panorama is that of the chain of Mont Blanc, from the defile of Balme to the left to the defile of Voza to the right. The summit of Mont Blanc was at a distance of about 12 kilometers from the operator. A second series represents the same chain taken from the Aiguillette at an altitude of about 2,200 meters. Finally, a third series represents the valley of Chamounix, seen from the slopes of Blaitiere at an altitude of about 1100 meters. For this series, the exposure was 30 seconds.

Upon considering these photographs, one cannot but be struck with the number of details that are remarked in the distances. This very important result is due to the use of orthochromatic preparations and of compensating glass.

Each of the negatives upon glass, in order to be seen in its true perspective, must be examined at about 42 cm. from the center of the plate. Their sharpness results especially from the accuracy with which the objective of the field glass and that of the enlarging frame was focused.

Owing to the ease with which this apparatus may be carried by an ascensionist, it is certainly destined to popularize horizons of which the contemplation has hitherto been reserved for a privileged few. The photographs obtained with it may be enlarged and give a true panorama of the most charming effect.—La Nature.

THE CASTNER CHLORINE PROCESS.

THE essential feature of the process is the employment of a moving body of mercury, which completely separates the products of electrolysis, and by its movements takes the place of a diaphragm, the sodium amalgam formed being decomposed as it is formed. The cell, which is divided into three compartments, is capable of being continuously rocked or tilted, so as to cause the mercury to flow from side to side. The two outside compartments contain the alkaline chloride solution and the carbon anodes, while the middle compartment contains an iron cathode and the caustic solution. The solution of the chloride is continuously circulating through the outside compartments, wherein it is being electrolyzed, and then returns to the saturators, where it is recharged with salt. The electric current traversing the salt solution liberates chlorine

and forms sodium amalgam. The chlorine escapes from each cell through an aperture into a collecting main, while the sodium amalgam, by the continuous back and forward tilting of the cell, passes to the center compartment, where it acts as an anode during the passage of the current, the sodium going into solution as caustic. A regulated quantity of water is admitted hourly to the center compartment of each cell, causing the pure solution of caustic to overflow through a discharge pipe into a large collecting pipe connecting all the cells. The cells are electrically connected in series, and are capable of being cut out or put into operation at will.

1. The electrical efficiency is 90 per cent. This high efficiency is due to the particular features of the process, and also to the fact that the sodium is removed from the mercury electrolytically as rapidly as it is formed, so that, actually, the mercury in circulation rarely contains more than 0·02 per cent. of sodium.

2. No hypochlorites are produced. The small loss of efficiency below the theoretical is not represented by chlorine combining with caustic, but by chlorine and sodium recombining to form salt.

3. The solution forming and carrying the electrolyte is in continuous use.

4. The wear of carbon anodes is so small as not to be of importance to the commercial result. In addition to the advantage the carbons possess in this process, owing to the absence of hypochlorites, they are previously treated by a special process which enables them to withstand the electrical action. So treated, it has been found possible to employ the ordinary pressed carbon instead of retort carbon.

5. The electromotive force required for each cell is but 4 volts for a current of 550 amperes. This low electromotive force is accounted for by the peculiar features of the process, the non-accumulation of sodium in the mercury, and particularly to the fact that the electrodes, cathode and anode, are brought almost into contact.

6. Each cell, which is 6 ft. long, 3 ft. wide, and 6 in. deep, decomposes 56¼ lb. of salt daily, producing 38½ lb. of caustic and 34½ lb. of chlorine in 24 hours, for an expenditure of 3½ indicated horse power.

7. The caustic solutions produced contain 20 per cent. of caustic soda, and yield by direct evaporation a solid caustic of 99½ per cent. purity.

8. The chlorine gas is of 95 to 97 per cent. purity, the balance being hydrogen.

9. The cells in operation are practically automatic, and require little or no attention. They are so simple in construction that a cell in full operation may be stopped, emptied, taken completely apart, put together again, and started in less than two hours by the labor of two men.

A cell in operation running at an efficiency of 88 per cent. gives the following actual results:

Per hour decomposes	1,068 grms. of salt.
Per hour produces	724 grms of caustic.
Per hour produces	642 grms. of chlorine
Per day decomposes	56¼ lb. of salt.
Per day produces	38½ lb. of caustic.
Per day produces	34½ lb. of chlorine.
Actual electrical horse power	Per cell 3
Indicated horse power	Per cell 3½
Salt decomposed per ampere hour	1·92 grms.
Salt decomposed per watt hour	0·48 grm.
Salt decomposed per kilowatt hour	1·06 lb.
Salt decomposed per indicated horse power hour	295 grms.
Caustic produced per indicated horse power hour	209 grms.
Chlorine produced per indicated horse power hour	183 grms.
Salt decomposed per indicated horse power day	16·00 lb.
Caustic produced per indicated horse power day	11·00 lb.
Chlorine produced per indicated horse power day	9·80 lb.

The plant, which has been erected in London by the Aluminum Company (Limited), to demonstrate on a large scale the commercial success of this process, consists of 30 cells, and has a daily output of 1,200 lb. of pure caustic soda, and 1,000 lb. of chlorine, with an expenditure of 110 indicated horse power.

It is reported that the process and patents for the United States have passed into the hands of the Mathieson Alkali Company, of New York and Virginia, and large works are in course of erection in America. The erection of works will also shortly be commenced in Germany and elsewhere on the Continent. Plans, etc., relative to the erection of works on a large scale in England have been completed.

THE LA BURT ELECTRIC RAILWAY CONDUIT.

THE recent developments in the field of electric railways operated by "underground trolley" have given considerable stimulus to work in that branch of locomotion, and with promising results. It will have been noticed that much of the work for which success is claimed is done with the deep conduit of the ordinary cable type, placed centrally between the tracks, with very heavy substructure and with the whole conductor system always in circuit. Many inventors believe, however, that this is by no means necessary, but that the desired end can be attained by means of a shallow conduit, by a line divided up into sections and by a conduit which is more or less sealed. An ingenious method proposed and experimentally introduced embodying all these highly desirable features is that of Mr John La Burt, represented by the La Burt Electric Railway Company, of 123 Liberty Street, New York City. The two clear cuts shown herewith render little explanation necessary. The conduit is 12 inches deep and consists essentially of a slotted rail, in the chamber of which a two-wheel upward-pressing trolley moves, attached to the car. This trolley in its forward or backward movement when the car travels lifts a rod which is in short sections, and which connects at junction or switch boxes 16 × 16 inch. At these boxes, the rod as lifted swings a plunger or rock lever into contact with a cup receptacle or plug socket which in turn connects with the main feeders of the line. This contacting device is inclosed within a small airtight box, 4 × 6 inch, impervious to moisture. As soon as the car leaves one section and passes to another, the trolley rod falls back to its supports, the contact device opens, and the section behind the car is left "dead." The only time the sections are "alive" is when the car lifts the rod and passes over them. As contact is made on the one section before it is broken on the other, the sparking of the contacts is reduced to a minimum, if not entirely eliminated. Under the trolley, on a prolongation of the stem, is a sweeper for keeping the shallow conduit clean. Access is readily obtained to the conduit through the switch boxes, which are at such short intervals that inspection or renewal of any part is easy and swift. Mr. La Burt states that this conduit can be built at from $10,000 to $15,000 per mile, according to the conditions and requirements; and that in no case can its cost at all approach that of the deep open slot conduit system with continuous conductors.—Electrical Engineer.

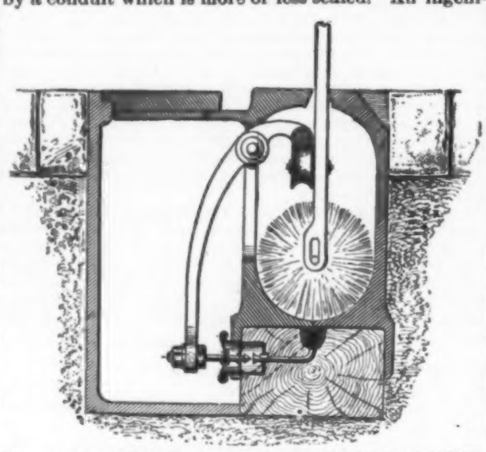


FIG. 1.—CONTACT BOX. LA BURT CONDUIT RAILWAY.

SIGISMUND SCHUCKERT.

ON September 16 death put an end to the long and severe sufferings of Sigismund Schuckert, the founder of the Schuckert establishments.

That the important part which he took in the development of electrotechnics was rarely recognized to its full extent was probably due to his extreme modesty. He has not only been the creator of one of the largest electrical establishments in the world, but the extensive use of continuous current arc lamps is especially due to him.

Sigismund was descended from a family which had long been established at Nurnberg, and was born there on October 18, 1846. He obtained his training in practical mechanics at Holler's mechanical works. After completing his apprenticeship his wanderings began, and he worked for five years at Stuttgart, Hanover, Berlin and Hamburg. Here a longing for foreign lands may have been excited in him by the business of the seaport and the social life of the free Hanse town. In May, 1869, this wish was gratified by a journey to America, where it was not difficult for the active and clever mechanician to find a livelihood. Here he became acquainted with Thomas Alva Edison. He was active for four years at New York, Baltimore and Philadelphia.

In 1873 he returned to Europe, not with the intention of remaining here, but of returning to America. Fate determined otherwise. His native city, Nurnberg, retained him, and he was prevailed upon to establish a workshop in his parents' house in the Johannis Street. He soon transferred it to the Schwaben Muhle, one of those old industrial establishments driven by water power. Here he worked for a time with a single assistant. At first he produced instruments of precision, and a pedometer of a novel construction was brought out at this time. He did not neglect his theoretical culture, however, and many marginal notes in the volumes of the Schuckert library give evidence of his industry. About this time he constructed his first dynamo. He relates how a friendly physicist wished to demonstrate that the machine which he was about to build could not act. The machine, however, acted so well that after being in use for twenty years it was bought back, still in serviceable condition, in memory of the past days. This machine, and those which followed it, were intended for use in galvanoplastics for silvering, nickeling, etc.

For a long time he was engaged with the idea of producing an electric light, which at that time was scarcely known by name, and in 1875 he had the pleasure of setting the first electric illumination in action. It was at the Sedan commemoration twenty years ago when the first arc lamps were used at Nurnberg. The correct insight with which he then determined his machine was to be, for him, of importance. The model which was subsequently carried out as Schuckert's "flat ring machine" marked for many years the summit of electrical achievement. It was not known then how to avoid the heating in the armature by subdividing the iron in thin plates and by powerful field magnets, but among the machines of that time which had more copper on the armature than in the field magnets, Schuckert's construction, easily ventilated and taken in pieces, was of the highest importance.

But the extended use of the continuous current arc lamp was destined to give the greatest impulse to Schuckert's work. Here Schuckert evinced the fullest command of the position. Then, when the alternating current lamps of Jablochkoff and Siemens were most prominent, he strove after the production of an effective continuous current lamp, and acquired the patents of Krizik. Under the name of the "Pilsen lamp" it penetrated into England, and from this lamp we must date the divided continuous current arc light.

The consequences of the introduction of the arc lamp were manifested in the development of Schuckert's works. The space in the Schwaben Muhle had long been found insufficient, and the works extended into the Schlossacker Street. In 1883, 100 workmen were employed, and in 1886, 200. With equal success Schuckert took in hand the parallel system of glow and arc lamps, especially the arrangement of arc lamps in pairs and of glow lamps at 100 volts. However ordinary and simple these things appear to us now, they experienced at first violent opposition. His representative at that time, Alexander Wacker, at present the general director of the Schuckert works, fought diligently in the technical journals for the new invention. Schuckert himself, in a polemical essay, wrote that time would prove the accuracy of his views. That he was right is proved by the constantly increasing development of his works.

In 1890 a thousand workmen were employed. He showed equal tact in the selection of his coadjutors. Among them are the well known electricians, Uppenborn and Hummel. The management of the business was assigned to A. Wacker. By their joint activity a new field of enterprise was secured, the erection of central electric stations for illuminating entire cities.

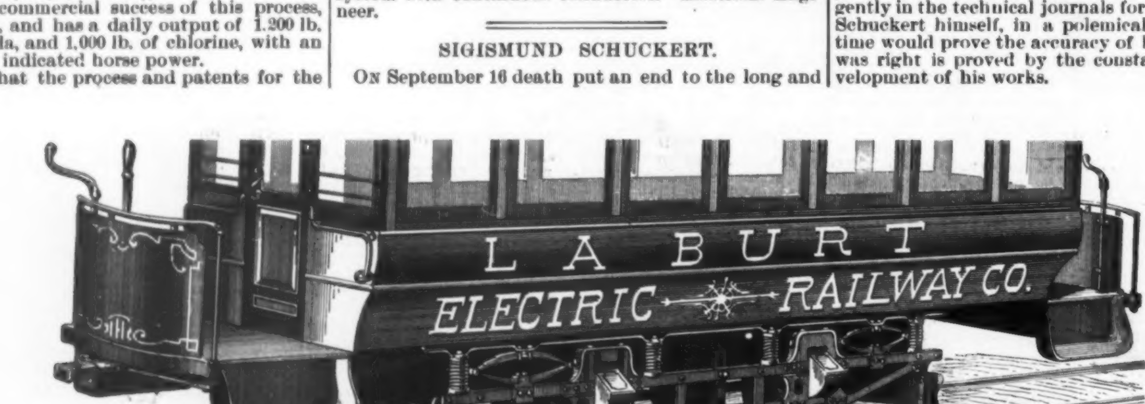


FIG. 2.—CAR SHOWING OPERATION OF THE LA BURT CONDUIT RAILWAY SYSTEM.

The results are too well known to be insisted on further. For the manufacture of dynamos, arc lamps and measuring instruments, as well as the accessory apparatus, more than 2,000 workmen are employed in the new works in the Landgraben Street.

How fully Schuckert was able to estimate the scope of new inventions appears not less from the introduction of the reflector. When Prof. Munker suggested to him to produce concave mirrors of glass by a parabolic motion of the polishing tool, he took up the idea with zeal. At this task he worked untiringly till success crowned his labors. Many a reflector was broken before the first useful specimen appeared. When on submitting them to the military authorities the superiority of the parabolic reflectors was brilliantly demonstrated, he felt no little pride when Werner von Siemens, who was always ready to recognize the merit of others, went up to him, took his hand and said: "Siemens bows down to Schuckert." He eagerly awaited the moment when the largest reflector in the world should send out its mighty rays at the Chicago Exhibition.

Amid all these successes, Sigismund preserved a modesty which was almost proverbial. Many a visitor at the Frankfort Exhibition passed regardlessly by the eminent man who never obtruded himself, but preferred to be lost in the crowd.

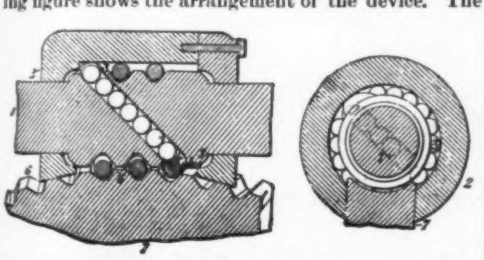
To his workmen and staff he was always a kindly father—indeed, he was simply spoken of in his works as "the father" Even during his last illness he was engaged with devices for the benefit of his workmen and officials.

He was not destined to see the last triumphs of his work. A nervous affection put an end to the activity of the energetic man, who, even during his disease, would allow himself no repose.

Whoever knew him, his untiring industry, his open and unassuming character and his constant regard for others, can never forget his personality.—The Electrical Review.

BALL SPUR GEARING.

MR. WELLMAN has made a judicious use of balls for the reduction of friction in a spur gearing. It is an application of the nature of the Lieb nut for elevators that we have already described. The accompanying figure shows the arrangement of the device. The



driving shaft, 1, revolving in a support, 2, is traversed by a channel, 4, provided at its extremities with guides, 3, 3, which cause the balls always to return to their starting point, after having, in rolling, pushed the teeth, 6, of the pinion, 7, before them. Like all applications of this kind, it owes its success to the precision with which hard steel balls for bearings are now made.—Revue Industrielle.

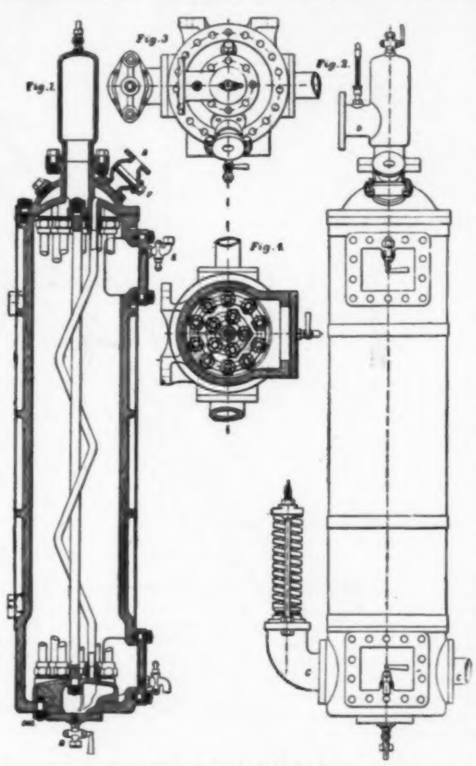
KIRKALDY'S FEED WATER HEATER.

THERE was a time not very long ago when a proposal to heat feed water with steam, taken directly from the boiler to be fed, excited open derision. It was argued that there must be a loss of heat in the process, due to the radiation from the pipes and apparatus, and that, therefore, it was more economical, and better every way, to heat the feed water inside the boiler than outside, unless some source of waste heat could be utilized in the latter case. This argument however did not cover the entire ground, and indeed omitted the principal object that those who introduced the live steam heater had in view. The pioneers in this great improvement in marine engineering practice were not so much striving after economy in fuel as economy in cost of repairs. They knew that in times of poor freights the earnings of a tramp steamer were often eaten up by the cost of renewal and repair of boilers, and that a wide field for saving existed in this respect. It was primarily to reduce this expense that they set to work, and probably were more fortunate than they ever anticipated in gaining at the same time a very genuine decrease in the amount of coal burned.

The troubles of a steam boiler are almost entirely due to want of uniformity in temperature in the various parts; if the whole of it could be kept at the same heat, there would be no strains other than those provided for by the designer, and none of that bending and tearing which is the chief source of leakage. This state of uniform temperature is certainly unattainable under any conditions, but it is a very serious aggravation of the variations that must necessarily take place if comparatively cold water be pumped into the boiler intermittently or continuously. It is only the familiarity arising from long continued use that has led engineers to follow a practice against which so many good reasons can be urged. Even yet, we believe, there exist some that are not sufficiently alive to the advantages of hot feed, both as regards its avoidance of racking strains in boilers and the collateral good it effects in reducing coal consumption.

To illustrate the subject, we annex a section of a feed water heater constructed by Messrs. John Kirkaldy Limited, of 40 West India Dock Road, London. As will be seen, the apparatus comprises a cast-iron case inclosed in fifteen coiled copper tubes, only one of which is shown in full. Live steam from the boiler enters the tubes from A, and is gradually condensed until it is finally delivered from the cock, B, to the hot well. Its heat is delivered to the feed water surrounding the tubes, the entering or hottest steam being surrounded by the water just about to leave the apparatus, the inlet for feed being at one of the bottom branches, C, and its exit at the top branch, D, the steam and water flowing in opposite directions. Above the branch, D, is a vessel in which air is trapped, and from which it is evacuated by a cock and a pipe ending in the hot well.

One of the collateral advantages attending the use of a feed water heater of this pattern is that it eliminates the oil and grease in the feed. Even if there be no oil put into the engine cylinders, some is certain to get in indirectly from the swabbing of rods, and it is most desirable to keep this out of the boilers. Only a fortnight ago Mr. A. J. Durston, Engineer in Chief R. N., stated, in the course of a presidential address to the Institute of Marine Engineers (see page 437 ante), that the loss of efficiency in boilers arising from a thin coating of grease deposit averaged 11 per cent. This certainly seems a high figure, but Mr. Durston's position, and the unrivaled means he has of making experiments, must secure acceptance for his statement. If, therefore, the grease is removed from feed water, a real economy is immediately obtained, and at the same



LIVE STEAM FEED WATER HEATER.

time the difference of temperature between the plates of the furnace and of the boiler shell is reduced. Every one knows that grease settles most thickly on the hottest surfaces; immediately it touches them it is grilled to the spot and retained. This is shown most clearly in the feed heater, from the fact that the bottoms of the tubes are often very thickly incased in grease deposit, while the upper parts are clean. At the present time there is a Kirkaldy heater on view at the office of Mr. R. Y. Mackintosh, 52 Quayside, Newcastle-on-Tyne, in which this localization of deposit is shown in a remarkable manner, the lower parts of the tubes being practically buried in it, while the upper parts are clean. The case appears to afford corroboration to the claim that all the grease is eliminated; unless this be so, it is difficult to understand why the upper parts of the tubes should be clean.

If an apparatus is to act efficiently, both as a feed heater and a grease catcher, it must be so designed as to be easily cleaned. The more effectually it stops the grease, the more does it stand in need of cleansing. In the heater illustrated there is a door at the bottom which can be removed when it is desired to clean out the greasy sludge with a scalding hose. If this be not effectual, the heater can be filled with caustic soda solution through the cock, E, and be kept at boiling temperature for some hours. The inside of the tubes can be cleaned in the same way by putting in the soda through the dirt arrester tray slot, and turning on the steam, the drain pipe to the hot well being temporarily disconnected. In extreme cases the tubes, with their tubeplates, can be removed in a piece to be boiled and scraped.

At the recent meeting of the Institution of Naval Architects in Paris, M. J. A. Normand, in a paper "On Water Tube Boilers," explained how essential were feed heaters to the good working of such boilers. If water enters the rising tubes below boiling point, it must travel for a certain distance without the formation of steam bubbles. For this distance it is but little lighter than the water in the downcomer pipes, and therefore the intensity of the circulation is decreased in proportion to the amount the water is below the boiling point corresponding to the pressure in the boiler. He said ". . . . active circulation is most favorable to vaporization. This explains how the advantage to be derived from the use of feed heaters is always superior to that which results from the economy in the units of heat saved. This is especially to be noticed with Mr. Kirkaldy's feed heater."

Dr. A. C. Elliott has also discussed the same matter in relation to the ordinary boiler. Before the South Wales Institute of Engineers he said: "There is a source of heat and a sink of heat, and there is the outgoing current and the ingoing current of the moving medium. If these currents experience the least possible resistance, if they have the largest possible volume, and if they work without warring with each other then the action is as perfect as possible in the circumstances. But if in some region remote from the original sink, cold water in considerable quantities is introduced, it is clear that we establish another sink. The two sinks will fight; some of the original currents will be stopped—new short circuits and eddies will be formed, and the whole complexion of the circulation will be changed." This sets the matter in a simple form, and the accuracy of the views here put forward is indorsed by the experience of engineers working under very diverse circumstances. Messrs. Kirkaldy have received orders for their live steam feed heaters corresponding to $2\frac{3}{4}$ million indicated horse power, an ample testimony that they give results of which the money value can be readily seen by the users, who, in some cases at least, would pay but little heed to theoretical reasoning.—Engineering.

THE CANADIAN SHIP CANAL LOCK AT SAULT STE. MARIE.

THE opening of Sault Ste. Marie Ship Canal, on the Canadian side, which took place on September 9, marks the inauguration of one of the most important public works thus far undertaken in Canada, ranking in its nature only second to the Welland Canal itself. This canal and lock, the location of which will become clear by an inspection of the accompanying map, is designed to carry large sea-going vessels around the 18 foot fall of the "Soo" Rapids, connecting Lake Superior with Lake Huron.

The total length of the new canal across St. Mary's Island is 3,500 feet, and the dredged approaches under water at the two ends are about 18,000 feet long, with a depth of water of 21 feet. The essential feature of the work is, of course, the lock by which the 18 feet fall of the Sault Ste. Marie is overcome. This lock is built of masonry, and is 900 ft. long between quoin posts, and 60 ft. wide, with a depth of water of $20\frac{1}{4}$ ft. on sills at low water. The height of the top of the walls above the floor of the lock chambers is $43\frac{3}{4}$ ft.

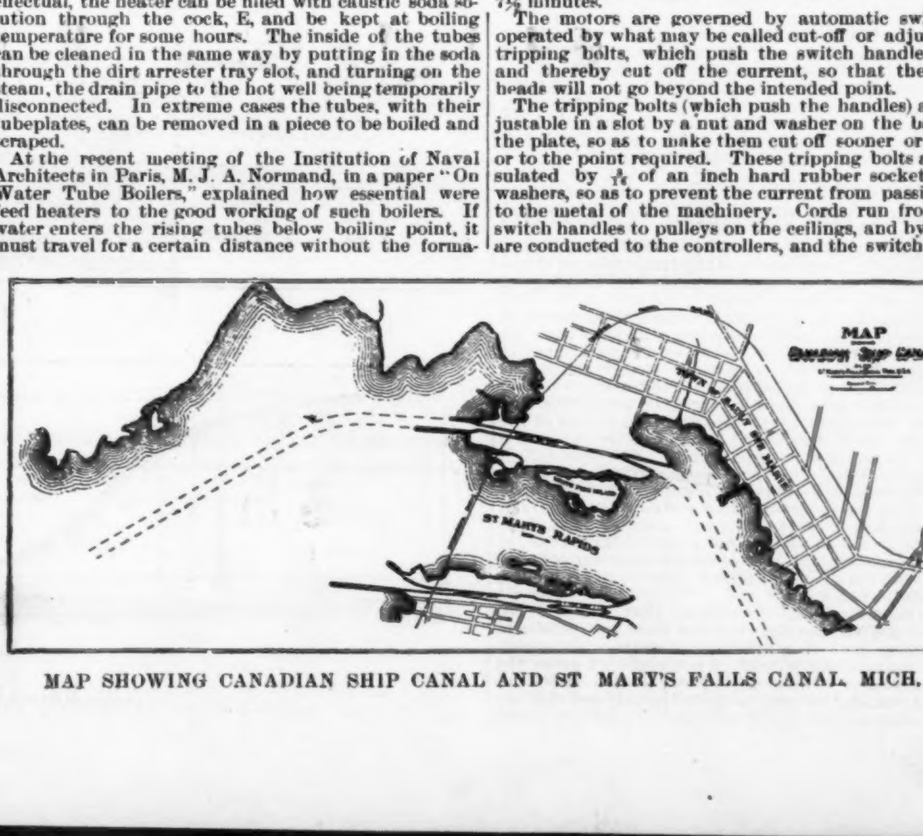
There are five sets of gates, two at the upper or west end, and three at the lower end, that is, a lock and guard gate at each end, and an extra or auxiliary lock gate at the lower end for immediate use in case the lower main gate should get injured. Two sets of these gates (the lower main and auxiliary) are $44\frac{1}{2}$ ft. in height by 37 ft. in width, weighing about 87 tons per leaf. The guard gates are, of course, to be used only when the lock chamber is being pumped out for examination or repairs. Water is admitted to the lock chamber by four 8 × 8 ft. culverts, extending under the breast wall and underneath the floor and having openings at their tops. The inlets and outlets to these culverts are closed by butterfly valves $10\frac{1}{2} \times 8$ ft. area, constructed of steel. Both the valves and gates are operated by electric power.

In all there are six gate machines, one for each leaf of the upper lock gate, lower lock gate and auxiliary gate. A one story wooden motor house covers each of the gate machines and its connecting motor.

With this machinery, from actual practice, the time required to pass a vessel through the lock going up stream is, after the vessel has taken her place in the chamber, 50 seconds for closing the lower gates, plus 50 seconds for opening the valves, plus 7 minutes for filling the lock, plus 50 seconds for opening the upper gates, or $9\frac{1}{2}$ minutes, altogether. As the lock can be emptied in 5 minutes, a vessel can be locked down in $7\frac{1}{2}$ minutes.

The motors are governed by automatic switches, operated by what may be called cut-off or adjustable tripping bolts, which push the switch handles over and thereby cut off the current, so that the crossheads will not go beyond the intended point.

The tripping bolts (which push the handles) are adjustable in a slot by a nut and washer on the back of the plate, so as to make them cut off sooner or later, or to the point required. These tripping bolts are insulated by $\frac{3}{16}$ of an inch hard rubber sockets, and washers, so as to prevent the current from passing on to the metal of the machinery. Cords run from the switch handles to pulleys on the ceilings, and by these are conducted to the controllers, and the switches are



MAP SHOWING CANADIAN SHIP CANAL AND ST MARY'S FALLS CANAL, MICH.

closed by the motorman pulling the cords without having to leave his position. By this arrangement the danger of damage to the machinery (from the cross head running ablock at the ends of the screws) is prevented.

The machinery which has been described is the first electric power machinery ever used for operating the gates and valves of canal locks. For both the old 1881 lock and the new 1,800 ft. lock on the American side of the St. Mary's River, hydraulic machinery is used.

The reasons which led Mr. James B. Spence, chief draughtsman of the Canadian Department of Railways and Canals, to adopt electricity were that the difference between electric and hydraulic power would be very trifling, and here the point of economy was not taken into consideration. Besides, one of the main objects of using electricity was to overcome the great trouble caused by frost when hydraulic machinery is used.

During the closing weeks of navigation the cold is so great that oil has to be used in the hydraulic engines placed on the lock walls, and even then the cold causes the oil to thicken and makes the action of the engines slow and tedious. Of course, frost would not have interfered with hydraulic valve engines placed at the bottom of the lock, but in this case eight engines would have been required, while only four screw power machines are needed with the machinery as designed. These considerations seemed to make it advisable to use electric power throughout.

Two 45 in. 155 H. P. turbines, equaling a combined power of 310 H. P., supply the power for operating the generators and pumps. One turbine will be used for running the generators, the other for running the arc light dynamo and general shop work, but when it is required to pump out the lock, the two wheels can be coupled and used to operate the centrifugal pumps. There are two of these pumps, and they have a combined capacity of 32,000 gallons per minute. The two pumps will lay the lock chamber dry in between 6 and 7 hours.

It should be noted also that near the upper end of the supply pipe there is a 6 ft. 8 in. valve operated horizontally by two Tobin bronze screws; also two 5 ft. valves are placed in the supply pipe immediately above the power house, permitting of either the whole of the pipes or of either or both turbines being laid dry when necessary. There is also an auxiliary 13 in. turbine for driving the incandescent lighting dynamos independently.

The electrical plant for operating the gates and valves and for lighting the canal and approaches was supplied by the Canadian General Electric Co. (Limited), of Toronto and Peterboro, under detailed specifications drawn up by the government electrician, Mr. D. Bryce Scott. The current for power purposes is supplied by two 45 K. W. 500 volt Edison standard bipolar dynamos, either of which is of sufficient capacity for operating under normal conditions.

The lighting plant consists of a No. 7 Wood arc dynamo, having a capacity of forty 2,000 C. P. lamps, and a 3 K. W. Edison bi-polar incandescent machine for lighting the power house and repair shops.

The motors operating the gates are the Canadian General Electric Company's 30 H. P. railway type, and are operated in pairs by parallel controllers, the connections across the canal being made by heavily armored submarine cables. The valve motors are also connected in pairs in exactly the same manner as described above.

The lighting of the canal and approaches is accomplished by means of a row of arc lamps down each side of the canal, situated about 300 ft. apart. These lamps are double carbon of the standard "Wood" type and are supported by means of iron poles and hoods placed on the top of 40 ft. poles.

In order to obtain perfect regulation without putting unnecessary strain upon the generators during idle periods, Mr. Spence placed a miter wheel upon the end of the turbine shaft, arranged to drive a horizontal miter wheel placed on an upright shaft which extends deep in the well and firmly secured in the bottom step. On this shaft are placed two propeller wheels of a size to meet the power required, one facing up and the other down, which causes no undue strain either up or downward. When the regulator is not required, such as when running the large centrifugal pumps, the horizontal miter wheel can be uncoupled. In this manner the object has been accomplished satisfactorily.

The lock, lock gates, and power house and all the valve and gate machinery were designed by Mr. James B. Spence, of Ottawa, to whom we are indebted for the information contained in this description, and the uninterrupted smoothness with which the entire work has operated since the opening of the new lock indicates the thoroughness with which every detail has been worked out.—The Electrical Engineer.

ELEVATOR FOR UNLOADING COAL BOATS.

MR. DE BILLY has recently proposed a method of overcoming the inconvenience resulting from the transportation of coal by water, that is, the difficulty of unloading.

Unloading by hand, which is the most rudimentary, longest and most costly method, has already been advantageously replaced by the steam crane, the use of which is attended with numerous inconveniences, as is also the crane actuated by manual power.

After studying a series of carrying apparatus, Mr. De Billy fixed upon a type that he made known at the last meeting of the Société Technique de l'Industrie du Gaz as being the simplest and most economical, and also as giving a new application to the gas motor.

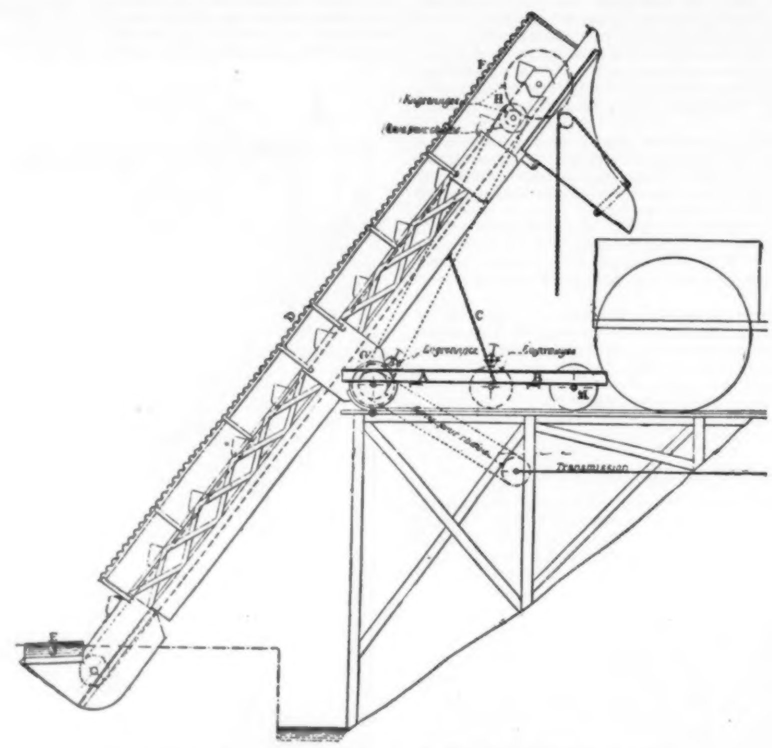
The Service of Bridges being opposed to the installation of a stationary apparatus along the wharves, it became necessary to render the apparatus completely movable. An ordinary noria with links formed of flat iron, and the buckets of which have an opening of 450 × 245 cm., is mounted, at a point near its center of gravity, upon a car.

The lengths are so distributed that the part ED shall be a little heavier than the part DF. A chain, C, winding around a windlass, maintains an equilibrium through the weight of the car, and gives the noria a greater or less inclination, according to the point at which the coal is to be raised, and also according to the slight variations of level of the watercourse.

Motion is given to the noria by a toothed wheel, G, loose upon the oscillating shaft, and with which an identical wheel, G', that transmits motion to the pinion, H, and thence to the bucket chain, is interdependent.

In this way the motion is continuous, whatever be the inclination of the apparatus, the distance between H and G remaining constant.

At the upper extremity there is a receptacle closed by a valve movable by hand, in which may be stored



ELEVATOR FOR UNLOADING COAL FROM BOATS.

a certain quantity of coal while one cart is making way for another. This continuity of work permits of unloading about 100 tons in 12 hours with a one-horse power motor, while for analogous work with a crane it would require a from 12 to 15 horse power engine.

It would not be impossible to arrange the apparatus so as to scoop the coal directly out of the boat, but the saving in one or two men that this would effect would not compensate for the complication introduced into the apparatus and the necessity of causing the position of the boat to vary continually. The coal is, therefore, thrown by shovel into the hopper, which, provided with two wide cheeks, J, is capable of receiving the coal in every direction. In this way the shiftings of the boat are no more numerous than with the crane.

After the work is finished the apparatus is wheeled to an appropriate place through a winch that actuates the axle of the car. A light corrugated iron plate protects the apparatus from rain.—Revue Industrielle.

THE BRIGHTON DIKE AERIAL ROPEWAY.

THE engravings, for which and the following particulars we are indebted to the Engineer, show by perspective sketch and by transverse section the Brighton Dike and the ropeway erected by Mr. W. J. Brewer, 15 Victoria Street, Westminster, on his system. The dimensions given with the dike section, Fig. 2, supply the chief particulars relating to this line, and some of the details of construction are shown by Figs. 3, 4 and 5. The system of construction differs from that of ropeways in use in many places in that the ropes which carry the load by means of pulleys, as shown in Figs. 3 and 4, are themselves suspended by brackets of anchor shape from a carrying rope acting as a suspending catenary. This main supporting rope is shown in section at the upper part of the anchor piece in Fig. 3, the upper gripping cap not being shown in place. It is, however, shown in Fig. 5. The suspending anchors have, as will be seen from Fig. 1, different lengths—the shortest being at the center of the span. The carriage, which at Brighton will carry about a dozen passengers, is suspended from the roller bridles, as shown in Fig. 3, the connections to the carriage or cage being broken off in the engravings for convenience. The two smaller rollers, shown at mid-height of the suspending brackets in Fig. 3, are for the support of the running ropes by means of which the cars are hauled across from side to side of the dike. Hauling machinery, consisting of a Crossley oil engine and winding drum, is placed in the small engine house shown to the right of Fig. 1. The suspension rods,

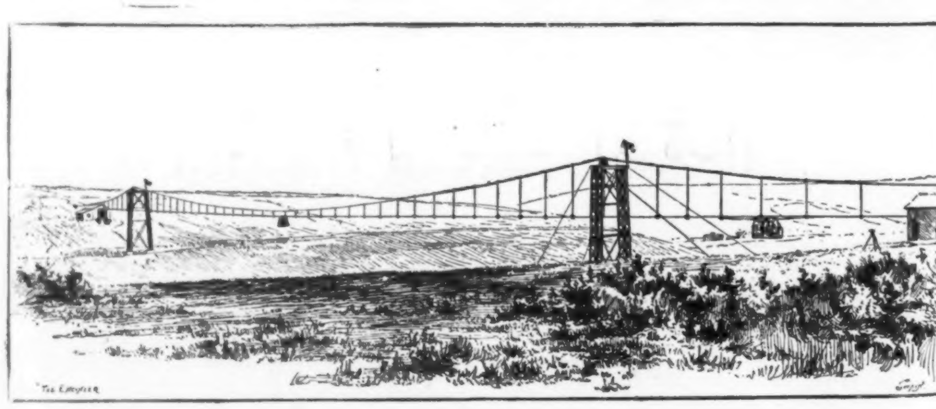


Fig. 1

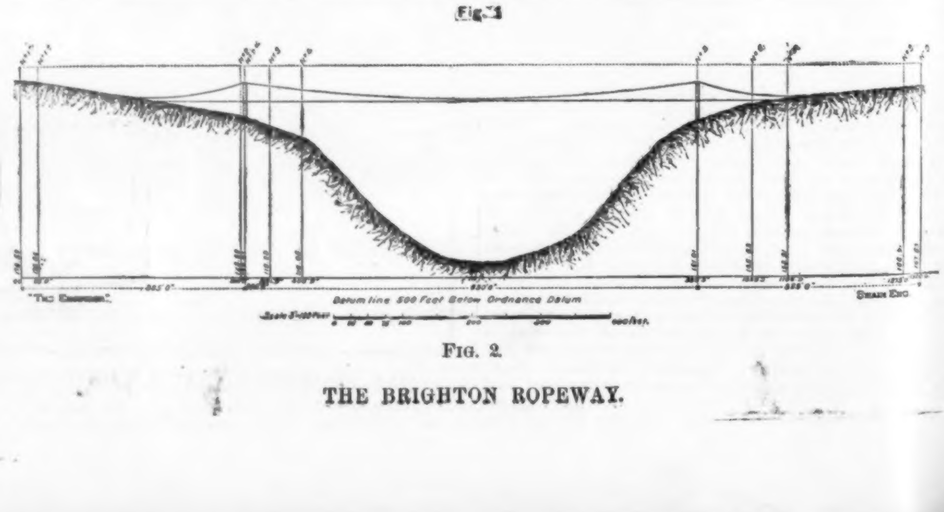


FIG. 2.

THE BRIGHTON ROPEWAY.

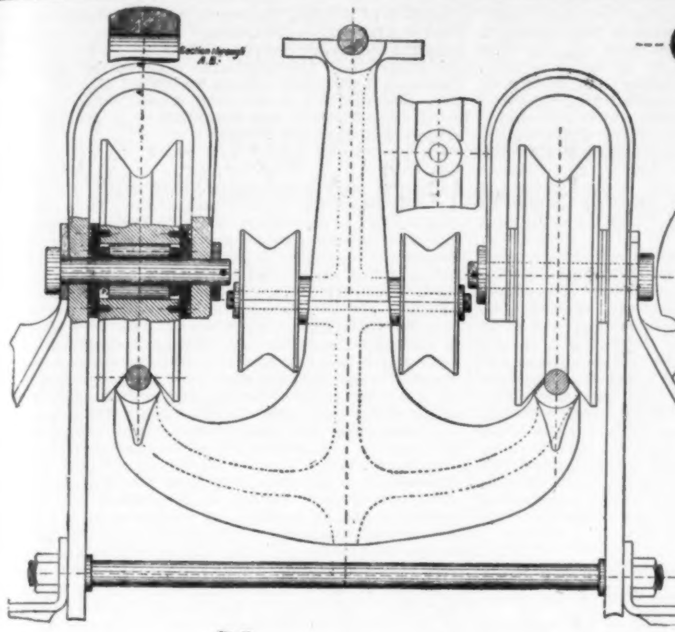


Fig. 3

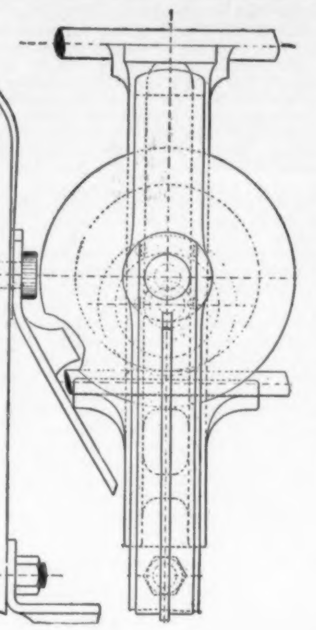


Fig. 4

which carry the anchor-shaped steel castings at their lower ends, are of steel 1 in. in diameter. The cables upon which the car rollers run are 1 in. in diameter and 18 in. from center to center. They are fixed to the steel casting by means of light clips, not shown in the engraving. Mr. Brewer has worked out a system of overhead ropeway or carriageway based to some

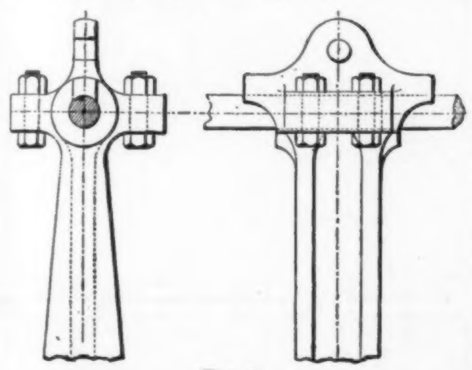


Fig. 5.

extent on that in use at Brighton, but with a rigid suspending rail instead of the wire rope carway—the design for this is shown by Figs. 7 and 8. As will be seen from these engravings, the hauling cable provides to some extent a guide for steadying the car or load-carrying box which is supported by means of rollers with bridles, as shown in Fig. 7, the rollers running upon the upwardly turned flanges of the central carrying rail. Although shown as designed for very small cars and loads, this system, it will be seen, lends itself to very considerable extension as to size, and will no doubt find numerous applications in large manufactories, quarries, and the like; the cost of a line capable of carrying a very large quantity of material per day being estimated at not more than £2,000 per mile, it being assumed that it would not be necessary to purchase land, but only to acquire a right of way, the elevated line not interfering with the usual use of the land. It will be seen that the arrangements adopted at the Devil's Dike might with but small modifications be made to take the place in many cases of a bridge of a more expensive kind, with the advantage that passengers may be taken across it by mechanical means. In many cases, it would be advisable that a slow speed of haulage for the cars on such a structure should be adopted, but in any case it might at least reach an ordinary walking pace and yet offer considerable advantages. The cableway at Brighton is probably the first of any notable span by which passengers have been carried, and it gives a good idea of what can be done in this way, although the hauling gear as we saw it might be much improved, and the speed lowered. An important feature is the wide span which may be carried in this way, and the removal of the wear of carrying rollers or wheels from the main supporting or catenary cable to others easily removable, each track cable being made capable of carrying the whole load, so that if one breaks, or the car slipped on one side, the other cable would carry it.

The inner end of the bridle pieces by which the cars are suspended from the rollers may, when thought necessary, be carried downward, so that even if a roller began to leave the track cable it would be brought back. The catenary cable, not being subject to wear of rollers, will have a long life, and one set of anchorages may be made to meet the requirements of several long spans. The oil engine employed at Brighton is of the 4 horse power normal size, and we are informed that 720 people have been carried across the dike and back in about two and a half hours at an expenditure for petroleum of 20d.

Fig. 7

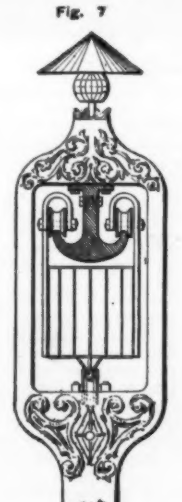
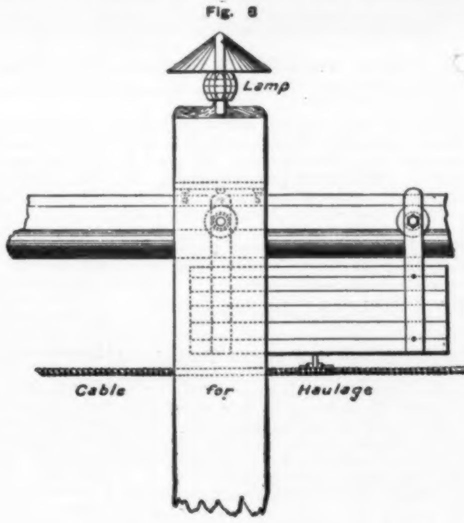


Fig. 8



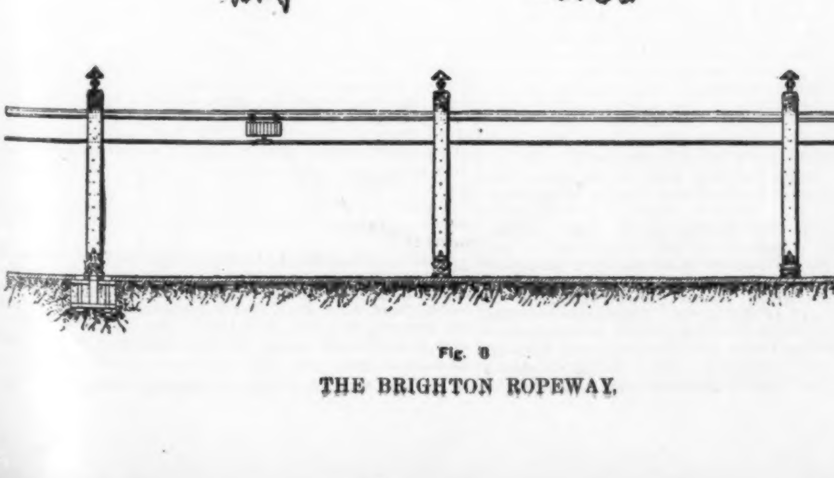


Fig. 6

THE BRIGHTON ROPEWAY.

[From Engineering, London.]

THE AMERICA CUP.

It is a deplorable thing that international competitions give quarrelsome people such a chance, and "the reptile press" in particular, so fair an opportunity to spit venom. The late contests for the cup, won forty-four years ago by the America, afford no exception to this rule. There are good sportsmen on both sides of the Atlantic—and who that knows both sides can doubt it?—anxious to have a good square and fair match; but because there is a hitch in the proceedings we have the whole pack, or, rather, the two packs, of irresponsible and mostly ignorant busybodies yelling any terms which appear to them most likely to annoy the other side. We have not had much to say about the America Cup, and we certainly do not intend to dwell on the litigious aspect of the case, but looking at the matter from a professional point of view, some remarks suggest themselves on the more wholesome side of the question.

Unfortunately only the very barest particulars of design of both yachts are known, and some of those not very certainly. The trials that have been made in the two races sailed were of a partial nature, but, so so far as they go, they show a decided superiority for the Defender. That is no more than might be anticipated. The smaller beam of the American boat—a complete reversal of past conditions—is all in her favor, and is, we think, sufficient to give her victory in any weather. We have formed this opinion, not on any basis of performance, but simply as a natural result following from the construction of the yachts. The Defender, it is said, is built of bronze and aluminum, the latter being doubtless the 6 per cent. alloy of copper and aluminum which has been found so effective in torpedo boat practice.

The heavier and stronger metal is, of course, mostly used below water level, where weight and strength are required, while the weaker and lighter serves for top sides and deck. The Valkyrie is of composite build; that is, her frames are metal—steel, no doubt—and her skin of wood. We have no positive information on these points, but they seem to be generally acknowledged as accurate, and doubtless are so. Now it is pretty certain that wood cannot compete with steel in regard to giving lightness and strength for hull structure. Mr. Thornycroft proved that years ago. Still less with aluminum, as Mr. Yarrow has more recently shown. It is true that a sailing yacht has different conditions to fulfill to those of a torpedo boat, with its quickly reciprocating machinery; but strength is very necessary in the hulls of racing vessels of modern design, having the enormous sail area and great weight of ballast low down.

No doubt the wood on the Valkyrie's top sides is reduced in thickness as much as is compatible with safety, but it can hardly be as light as steel, and certainly must be much heavier than aluminum. There are, of course, objections to the use of steel, for yacht-building purposes, and these are generally considered sufficient, with sailing yachts, to outweigh its advantages. By the use of a strong bronze the Herreshoffs have got over these difficulties, and in combination with the aluminum upper structure, have gained one advantage, which goes far to account for the sufficient stability provided with a smaller width of boat. By the use of bronze as an integral part of the hull structure the advantages of a smooth under-water surface are obtained without the weight—useless for giving structural strength—that is generally spent in coppering. The lighter metallic construction of the Defender allows her to carry a greater weight of ballast to make up for the narrower beam. She thus has, therefore, stability equal to that of a broader vessel built of heavier material, and can carry an equal sail spread, which naturally drives the narrower hull at a greater speed.

This is but one feature in the comparison, and, although a very important one, it doubtless does not make up the total of superiority due to the new departure. It is probable that not only in broad general features the design of the Defender excels, but also by minute attention to every little detail. We well remember seeing over here, and indeed, sailing, the first boat sent to this country from the now famous Bristol yard. It was full of new and ingenious devices, and every device was not only ingenious, but practical. One point we especially remember was the construction of the blocks. They were all of metal, small and light, yet with ample dimensions where size was necessary, that is to say, they would take all their ropes without fear of jamming. At that time our highest flight was a "Gravesend block," certainly a great improvement on the old rope-stropped block, but not to compare to the American's. Then the Herreshoff torpedo boat came across, designed by the same man who has designed the Defender. She was also full of original and ingenious mechanical—tricks, we were about to say, but that would not be a fair word considering the boat beat our then best English speed by three-quarters of a knot. If the workmanship and material had been equal to that of our own builders, the victory would have been more complete. The next boats the Herreshoffs sent were built, like the torpedo boat, to the order of the British Admiralty. They were two vedette boats and two steam cutters. They were of wood, and again Yankee ingenuity was apparent to a marked degree. We were at Sheerness at the time the trials of the cutters were run, and well remember the surprise and admiration expressed by naval officers and dockyard officials at the many original and thoughtful features in the design. These boats far eclipsed in speed the English boats of the same class, but Mr. John Samuel White, of Cowes, scored a decisive victory when it came to consumption trials; but then the boats were ordered on a speed basis, not an economy basis, and Rhode Island is peopled by a practical race.

In the first Herreshoff boat sent over—the torpedo boat referred to—there was certainly not much to admire beyond the ingenuity in the design, unless it was

the excellence of the cast iron in the link motion. Never before was there such a vessel in the British navy; so novel and ingenious in design, so bold and original in execution. The steel plating on the sides was undulating as the sad sea waves, the riveting was of a picturesque pattern, the steam piping was on the gas fitting system, the floors were of deal—"lumber" they call it in the States—the engines were away in the bow—with cylinder tops screwed on like the lids of jam pots—the propeller shaft was sprung (intentionally) 3 in. out of the straight; but brilliant as the execution was in boldness, it was far outshone by the boldness in presenting the craft for acceptance to the Lords Commissioners of the Admiralty; but awe of British officials is not an element in the Rhode Islander's character.

Much as this boat ruffled the serenity of the minor purists at Whitehall, the chief officials had the sense to recognize her merits of design and the success of her achievements. She was accepted, paid for, and the practical Rhode Islanders went home, leaving a European reputation behind them, and taking the cash in their pockets. They also left a model, rough, perhaps, in many respects, but one that has influenced the design of torpedo craft more than any single boat of her class yet built.

We have, perhaps, rather wandered from our subject in our wish to show the kind of people British yachtsmen have to deal with in trying to win back the America Cup. Men who, when they have an end in view, go straight for it, not hampered overmuch by sentiment, undiverted by side issues, never discouraged by difficulties; resourceful, and, above all, quick to seize new ideas when they have practical value. That Noah built the ark of wood was not sufficient reason for the Herreshoffs to build the Defender of the same material.

We fear it will be long ere the America Cup makes a voyage back across the Atlantic. In the first place, the challenging yacht is under such great disadvantage, and in Nathaniel G. Herreshoff the Americans have a designer who seems to have been brought into the world and trained for the express purpose of keeping the cup in America. He has salt water in his blood; it comes to him direct from his father, who was a yacht sailor from youth to old age.

We once paid a visit to the Bristol yard, and well remember the stately old gentleman. He would sit on the little pier in front of his house looking down the bay until a large sloop or schooner came in sight. By the time she was abreast the house, Mr. Herreshoff would be slipping the moorings of his big cat boat, and likely, would not be seen again for the rest of the day. At supper a contented smile on his face would indicate that he had beaten his big antagonist; a look half annoyed, or, perhaps, one should say, a trifle more thoughtful than usual, would mean a less satisfactory result. Old Mr. Herreshoff had in his boat, which he invariably sailed single handed, a railway laid from side to side. On this there was a trolley carrying a heavy weight of ballast and controlled by a rope. In tacking, when the boat was in stays, and at the critical instant just before she came upright, the trolley was eased by the rope into the lee bilge, which immediately became the weather side, so that this heavy weight of ballast was to windward. It is possible that a recollection of this device had something to do with the extra hands on the Vigilant, who did such yeoman's service as shifting ballast.

Brought up among such surroundings, and on the edge of Narragansett Bay, a healthy boy could hardly fail to take to salt water, and the Herreshoff lads were like a litter of young seals in this respect. Nat was the quietest and most observant, although he may not have possessed the originative faculty so fully as his elder brother James, yet he thought more about the shapes of things and the reasons of shapes. When he grew up, he was sent to an institute of technology, where he received a scientific training in mechanics, physics and other branches of applied science which form part of the engineer's profession. Afterward he joined the Corliss works, in the neighboring city of Providence, where he finished his education as an engineer by practical experience in actual work. Ultimately he joined the works that had in the meantime been growing under the guidance of his brother John, assisted more or less by the other brothers of the family.

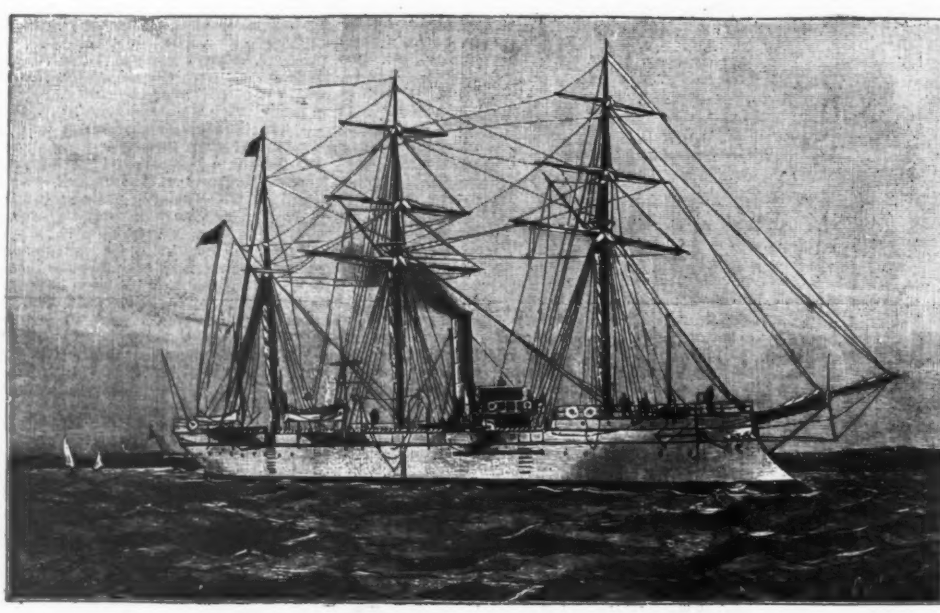
That is the man we have to beat before we can get back the America Cup. Observant, thoughtful, level headed, as much at home at the tiller as in the designing office, with a scientific training and an instinctive perception of the shape a boat should be to go easily through the water and carry her canvas. Shut him up alone in a room, there is not a detail in the vessel he cannot design; put him in the workshop, there is not a part he cannot construct with his own hands. But these things, although essential to the highest type of yacht designer, are, in our opinion, subordinate to the abundant resourcefulness, the brilliant inventive faculty, which has always distinguished the New England race, and which finds highest exemplification among such men as the Herreshoff brothers. It is here, we think, that our own yacht designers have failed. We have lived through the old style when the clever builder of fishing boats—whose drawing instruments consisted of a piece of chalk, and whose mathematics stopped at the multiplication table, if they went so far—was the yacht architect, and now our designers can calculate displacements, stability, centers of effort on lateral resistance, and other elements of design with the best. But, British-like, we are still too much hidebound by traditions of the past. Probably the majority of people think that yacht designing consists of a laborious working out of that "form of least resistance" about which we used to hear so much in years gone by. To determine the shape of the hull is an elementary part of the yacht architect's business. Of course it is an important element, but with a given midship section there is not so very much latitude in forming the ends. The ingenuity of yacht designers for some time past has been chiefly exercised in obtaining the maximum water line when the boat is under way, combined with the minimum water line when at rest. That is the result of the measurement for rating. But shape is, as we have said, only one element of design, what we want further are devices, dodges—tricks if you will. The bulb keel was a device, and succeeded admirably with small craft. Devices for lightening spars and rigging, devices for making sails set flat, and above all devices for getting a better distribution of weight in the hull, so as to raise the metacenter, are what we have to consider now. We much fear that some of our existing yacht architects have not the knowledge of mechanical principles and of the qualities of metals and alloys which will enable them to cope with the well informed and quick witted Yankees. In the Defender we see unmistakable evidence of the training of her designer in the torpedo boat school; and, for our own part, if we were going to build an America Cup champion, we should be inclined to go first to one of our own torpedo boat builders.

There is only one other point to which we shall make reference. In sailmaking we in England are far ahead of the Americans. That we think is acknowledged, and what would have been the relative positions of the two yachts had they been canvased alike it is not pleasant to contemplate. It was not always like this, for a great part of the America's success was attributed to the better setting of her sails. We gather from Mr. West's photographs that the Defender's mainsail has horizontal cloths. That seems a foolish thing, but in any case the British made canvas is far superior. If, therefore, we could get out a hull equal to the American's, before they can train up a good sailmaker, we might win the cup, but to do that English yacht designers will have to study the properties of materials more closely than they have hitherto.

THE LOSS OF THE SPANISH WAR SHIP SANCHEZ BARCAIZTEGUI.

THIS vessel was sunk at the mouth of the harbor of Havana, on the 18th of September, by collision with a merchant steamer named the Mortera. The war ship started upon her voyage along the Cuban coast at 11 o'clock at night, and just as she was emerging from the harbor near the Moro castle, the collision took place which caused the vessel to sink within a few minutes. She had on board a crew of 146 men, including officers. Of these 31 were lost, among whom were the Rear Admiral Senor Delgado Parejo and the commander, Senor Ibanez, who remained at his post to the last, giving orders. His body was recovered, but without head or arms, having been eaten by sharks.

It is said the accident was cau-ed by the sudden extinguishment of the electric lights on board of the war steamer, which rendered the vessel invisible to the other approaching ship.



THE SPANISH WAR SHIP SANCHEZ BARCAIZTEGUI.

THE PEARY AUXILIARY EXPEDITION OF 1894.

WE have received number five of the Bulletin of the Geographical Club of Philadelphia, containing an account by Henry G. Bryant, secretary of the club, of the Peary Auxiliary Expedition of 1894, to Greenland, of which expedition he was commander. It is illustrated with many photographs, and also contains reports of the geologist, zoologist, botanist, etc., from which we make the subjoined abstracts.

Interest in Greenland exploration has been stimulated in America within the last four years, by the two expeditions of Civil Engineer Robert E. Peary, United States Navy, and many of that generation which followed the achievements of Kane, Hayes, and Hall with acclamation are still interested in the outcome of this latest attempt to wrest from nature the secrets which still lie hidden in the solitudes of the far north.

As a result of a preliminary journey to the west coast of Greenland, and a reconnaissance on the inland ice, in the summer of 1886, Lieutenant Peary determined to organize an expedition with headquarters in the Inglefield Gulf region, where the inland ice was more accessible than farther south. The uniqueness of his plan consisted in the utilization of the smooth surface of the interior snow cap as a means of advance, and he asserted that, to a properly equipped sledge party, this great white plane presented an "imperial highway" to the north. The success of this new departure in Arctic travel was fully demonstrated by the results of the Peary North Greenland Expedition of 1891–92. By minute attention to the details of his equipment, the use of concentrated food and the adoption of a light, Eskimo style of dress, Lieutenant Peary, with one companion,* succeeded in making a remarkable sledge journey of some 1,300 miles over the inland ice. He eventually reached 82° north latitude and made observations which led him to believe that Greenland was an island, separated by a well defined channel from the detached land masses which extended toward the north.

On his second expedition, which reached Bowdoin Bay—a northern indentation of Inglefield Gulf—on August 3, 1893, Lieutenant Peary hoped to profit by the lessons of his first attempt, and furthermore, by making an earlier start, to reach Independence Bay, the limit of his former journey, early enough in the season to undertake a dash over the sea ice toward the outlying islands which he had observed stretching to the north toward the polar area. His plans also included the dispatching of a subsidiary party from Independence Bay down the unknown northeast coast of Greenland as far as Cape Bismarck (latitude 76° 47'), from which point a retreat was to be made across the interior to the headquarters at "Anniversary Lodge," on Bowdoin Bay. The successful execution of these plans would have been a noteworthy achievement in Arctic annals, and great interest was manifested in the issue of Lieutenant Peary's undertaking.

Before leaving for the north on his last journey, Lieutenant Peary had arranged for the dispatch of the steam whaler Falcon, with a relief party, whose mission it should be to reach Anniversary Lodge and afford the explorers the opportunity to return in safety to the United States. Lieutenant Peary himself provided the greater part of the money required and the direction of the undertaking—known as the Peary Auxiliary Expedition of 1894—was placed in the hands of the officers of the Geographical Club of Philadelphia. In the spring of the year 1894 the organization of the party was intrusted to Mr. Bryant.

As subordinate to the main object—the relief of Lieutenant Peary's party—the plans of the expedition included a search for traces of the Swedish naturalists Bjorling and Kallstenius, and an examination and survey of the unknown north shore of Jones Sound.

Professor William Libbey, Jr., geographer; Professor T. C. Chamberlain, geologist; Dr. Axel Ohlin, of Sweden, zoologist; Mr. Emil Diebitsch, civil engineer; Mr. H. L. Bridgman, historian; and Dr. H. E. Wetherill, surgeon, became members of the party.

At St. Johns, N. F., the steam whaler Falcon, a bark rigged craft of 311 tons, had been chartered for the voyage, and on the afternoon of July 7 the steamer swung out from her pier and slowly made her way down the harbor.

Nine days after leaving St. Johns the Falcon dropped anchor in the harbor of Godhavn, the Danish colony on the island of Disco, where lives Herr Anderson, the inspector of North Greenland, a mild autocrat, who presides over the destinies of some 135 Eskimo subjects. The Danes re-established colonies in Greenland in 1721, and thirteen trading districts are comprised within the north and south inspectorates—the two principal political divisions of the country. Of late years the value of the Greenland trade has fallen off greatly.

After paying an official call on Governor Elmquist, most of our party started on an excursion up a glacial river valley known as the "Blaese Dael;" this jaunt proved to be most interesting, taking us, as it did, past the sculptured, basaltic columns of the region, over miles of rich green-sward dotted with countless wild flowers glowing in the splendor of their summer beauty; high up the mountain side, across glaciers and over snow banks to the base of the ice cap of Disco Island. Here, from an elevation of 1,800 feet, a glorious view of Disco Bay, dotted with hundreds of icebergs from the Jacobshavn Glacier, entranced our vision and made a picture which will long live in memory.

Two days passed quickly, and the Falcon, on the evening of July 17, was steaming once more toward the north.

Three polar bears fell victims to the rifles of the party. The skinning of these proved to be exhausting work to the amateur taxidermists, who were engaged on the work from 6:30 P. M. until midnight. At that hour the sun was shining brightly in the northern heavens and the distant peaks of the mainland reared their

* Mr. Eivind Astrup, of Christiania, Norway.

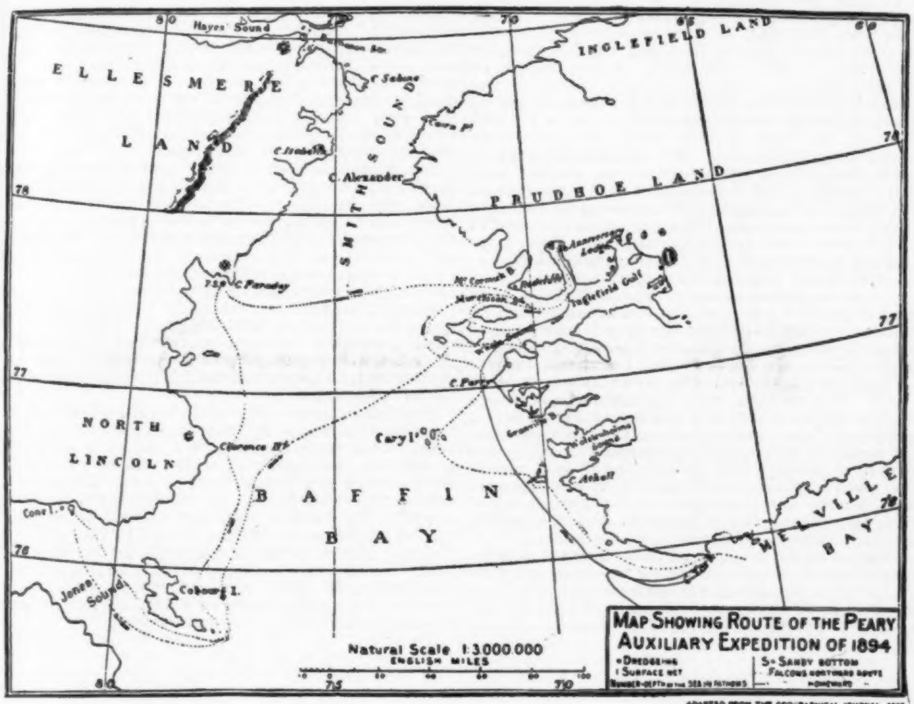
massive outlines above the bank of fog which hung along shore. All about extended vast quantities of loose pack ice, chilling the air and adding a desolate splendor to the scene. We had already encountered considerable of this heavy pack ice and were anticipating some difficulty in the passage of Melville Bay. The Falcon entered the confines of this dreaded battle ground of Arctic navigators early in the morning of July 20.

Thick ice was encountered, many of the severed pieces revealing edges of fully forty inches. Oftentimes the approach to a favoring "lead" would be barred by a "neck" of this thick ice forty or fifty feet in width. Against this the Falcon would advance at full speed. Not only once, but over and over again would this maneuver be repeated. The stanch old ship, with her prow sheathed in iron and protected below the water line with greenhart planking, stood the force of these impacts with impunity, although the havoc wrought among the dishes in the saloon and cook's galley was something to be remembered.

The experience of the four Peary expeditions which have crossed Melville Bay eight times during the past four years goes to prove that the traverse can be successfully made, in an average season, any time after the third week in July.

July 22, when in sight of Cape York, which is regarded as the northern boundary of Melville Bay, the ship was beset in the ice, which, impelled by some mysterious force, closed in with a harsh, grinding noise. In front and to the rear the huge "pans" crunched together, forming hummocks along the line of resistance, and at the same instant impelling the superimposed sheets against the sides of the vessel with great force. Slowly the black hulk of the Falcon was raised up, and directly after given a "list" of nine degrees to the port side.

After a detention of thirty-three hours, the ice mysteriously opened up and permitted the ship to proceed to Cape York, where they arrived on July 23. This promontory marks the southern boundary of the habitat of the northern Eskimos, who were named "Arctic Highlanders" by the first white men who visited them in 1818. From time immemorial Melville Bay, with its inhospitable shore line, has been the impassable barrier between the primitive Eskimos of the north and the more civilized natives of the Danish settlements



MAP SHOWING ROUTE OF THE PEARY AUXILIARY EXPEDITION OF 1894

ADAPTED FROM THE GEOGRAPHICAL JOURNAL, 1895.

The Falcon was anchored for some hours to the shore floe near Cape York, and the natives were soon swarming about the ship.

Although enjoying none of the so-called advantages of civilization, these natives contrasted most favorably with the southern Eskimos, who have been under the Danish influence for more than a hundred years. The latter have so large an admixture of white blood among them that it is well nigh impossible to find a genuine Eskimo type in the more important settlements, while in spite of the well meant solicitude of the home government many of them, weakened by the excessive use of coffee, tobacco and European clothing, are losing their skill as hunters and falling victims to pulmonary and other diseases. On the other hand, we found no sign of deterioration among the small tribe of "Arctic Highlanders," who number all told only about 250 members. These interesting people possess all the virtues of isolated, primitive savages and seem to be holding their own from year to year in that bleak region, where, to a white man, mere existence seems to be nought but a hopeless struggle with the forces of nature.

Pressing on, the course was set for the Cary Islands, to visit the site of the last camp of the Swedish explorers.

Alfred Bjorling, an accomplished young botanist of Stockholm, was but twenty-one years of age when he undertook the leadership of this expedition to the Smith Sound region. Although so young, he had already made his mark as a resolute and ambitious traveler. He was the first to ascend the peak of Kebnekaisse, the highest mountain in Sweden. Later on, he visited the west coast of Spitzbergen as a member of a Swedish expedition. In 1891 he reached Upernavik on board a Danish trading ship, and, with a native crew in a small boat, made a journey as far north as the Devil's Thumb, in Melville Bay. In May, 1892, with a fellow student named Kallstenius, he arrived in St. Johns, N. F., to perfect plans for reaching Ellesmere Land. Finding he was too late to secure passage on any of the whalers, with the scanty means at his disposal he purchased a small schooner named the Ripple, which was regarded as unseaworthy by the prudent skippers of St. Johns. After much difficulty he succeeded in obtaining a crew, and, at length, with high hopes for the future, and heedless of impending dangers, embarked on his last fatal voyage.

The Ripple, with its crew of two sailors and a cook, brought them in safety to Goodhavn, where they purchased a rifle, shotgun and a small boat. On August 3, the five men sailed from Godhavn and were never afterward seen alive. When autumn passed and no news of them reached Europe, their friends in Sweden, including Professor Nordenskiold, took measures to ascertain their fate. In a letter from Godhavn, Bjorling had stated that he would leave a message on the Cary Islands, whither he proposed to go to replenish his stores from the English depot left there by Nares in 1875. The Scotch whalers sailing from Dundee were requested to visit the Cary Islands and look for this message. At length, in November, 1893, the whaler Aurora arrived at Dundee, and brought the first news of their movements. Captain McKay reported that in June, 1893, the lookout on his vessel had discovered the wreck of a schooner on the shore of southeast Cary Island, which, on examination, proved to be the Ripple. The landing party also found the body of a man under a heap of stones near by, and in a cairn discovered four messages written by Bjorling.

From these messages it appeared that Bjorling reached the Cary Islands on August 16, 1892, and that his schooner was driven ashore the following day while the men were engaged in transferring the provisions from the English depot to the ship. This was the greatest misfortune that could have befallen the party, and not only destroyed their hopes of exploring Ellesmere Land, but endangered their chances of returning to the Danish colonies. The most obvious course for them to have pursued was to have embarked in their small boat for Cape Parry, twenty-five miles to the eastward, and to have made the most of what remained of the summer in retreating south. On the Greenland coast they would possibly have been picked up by the Kite, the vessel which passsed Cape Parry on August 24, having Lieutenant Peary on board, who was returning home from his first expedition. In any event, had winter caught them unprepared, they would have been assured of kind treatment at the hands of the Whale Sound Eskimos. Instead, however, of taking measures to escape, Bjorling, after wasting valuable time in a northern boat journey, conceived the desperate project of undertaking a voyage in an open boat to Clarence Head, on the western side of Baffin Bay. In his letter he stated that he would endeavor to return to Cary Islands by July 1, 1893, in hopes of meeting a whaler, and closed by appealing as follows to any whaling captain that might receive his message:

"I shall be very much obliged to you if you will go to Clarence Head (50 miles off), where I shall leave in a cairn information relative to our fate during the winter. Our provisions, if I cannot find Eskimos, will not last beyond January 1. We are now five men, one of whom is dying."

This last letter was dated October 12, 1892.

It was late in the afternoon on July 24, 1894, an ideal Arctic day, that the Falcon reached the bleak and desolate Cary Island, which a wealth of bright sunshine could not relieve of its aspect of dreariness. No sign of the wrecked schooner Ripple could be found, but the site of the last camp of the Swedes was located. Here the retreating snow revealed scattered about in confusion numerous memorials of the brave but foolhardy adventurers. A silver watch, zoological note book, botanical press, and a few other articles were selected from the mass of relics.

On the shore of Robertson's Bay, almost due north of our position at that time, was located the small village of Igloo d'Hominey, which may be regarded as the most northerly permanent settlement of human beings on the globe. The day following our arrival, five natives from this place came across the bay ice on their dog sledges to visit the ship, and we learned from Meuh, their spokesman, that the Peary party were all well, and, furthermore, that in his opinion their quarters could be reached in "two sleeps."

The Falcon again attacked the ice, hoping to reach a "lead" which opened up in the desired direction. By means of continuous ramming and butting and the occasional use of blasting powder when the floes pressed us too closely, we finally reached open water, and by following the narrow and tortuous passages between the ice fields, were able to advance about five miles up Inglefield Gulf, to the edge of the unbroken winter floe. We were now in sight of the settlement of Karnah, whose inhabitants, old and young, straightway forsook all other pursuits and lost no time in reaching the wonderful "Oomiaksoak," where they were sure of a kind reception and a great feed at the hands of Larry Hackett, our kind hearted steward. A reward had been offered by Mr. Peary for the first news of the ship's arrival, and the welcome tidings were first carried to "Anniversary Lodge" by two native couriers, on the evening of July 31. Lieutenant Peary dispatched Mr. Entrikin to the ship in company with the two enterprising Eskimos, the same evening, and thus it happened that early on the morning of August 1 the cry of "Kablunah" (white man) raised by the natives, brought me on deck in time to grasp the hand of Mr. Entrikin, as he clambered over the ship's side.

Great was our regret to learn from him of the failure of Mr. Peary's sledge journey on the inland ice and the consequent postponement of its execution until the following year. After a very brief delay, Mr. Entrikin announced that he was ready to return to headquarters, and, accompanied by Mr Diebitsch, and drawn by the two identical dog teams which had already twice made the thirty mile journey within twenty-four hours, we set out for "Anniversary Lodge." I doubt if anywhere on the globe there assembled that evening a happier company than the one which greeted our arrival at Falcon Harbor in front of "the Lodge." Lieutenant Peary was gratified to find his relief steamer reporting on time, Mrs. Peary delighted to find that I brought with me her brother, Mr. Emil Diebitsch, and the others glad to welcome new faces to their camp and to receive letters from family and friends. In due time we were presented to the new member of the North Greenland expedition, Miss Marie Anigheto Peary, whose little life had grown and blossomed into loveliness under the rays of the North Star as other children's lives had grown amid the comforts of more genial climes.

After a conference with Lieutenant Peary, it was decided to carry out the prearranged programme of the expedition and to visit Ellesmere Land to continue our search for traces of the lost Swedes and also to attempt the exploration of the north shore of Jones Sound. Leaving Professor Chamberlain to pursue his studies of the glaciers about Bowdoin Bay, the Auxiliary Expedition, reinforced by the presence of Messrs. Astrup, Entrikin, Vincent, Carr, Davidson, and Swain, of the Peary party, started on August 4 for Cape Faraday, Ellesmere Land. After thirty-six hours' struggle with the ice in Murchison Sound, the open water of Baffin Bay was reached, and on August 7 we succeeded in pushing our way through the belt of ice which impinges the east coast of Ellesmere Land, and succeeded in landing at Cape Faraday, being, as far as I can learn, the first party of white men to land on the west coast of Baffin Bay, between Jones Sound and Smith Sound.* No trace of the lost explorers was found here, nor at Clarence Head, a bold headland to the south, where in company with Professor Libbey and Messrs. Astrup and Diebitsch I went ashore on August 8. Before returning to the ship, cairns were built on prominent points at both places in which records of our visit were placed.

Had the unfortunate travelers ever succeeded in landing at Cape Faraday or Clarence Head, their position would have been a desperate one. The entire coast line consists of a succession of precipitous headlands, crowned by the changeless snow cap which discharges by numerous glaciers into the sea. No traces of game or of the recent presence of Eskimos were found,† and on leaving these desolate shores, we had the sad satisfaction of establishing the fact that the young Swedes never succeeded in reaching the western mainland.

The exploration of Jones Sound, with all its possibilities of original geographical research, was now before us. Finding Glacier Strait icebound, we made our course through the pack ice south of Coburg Island into the sound. For six hours we steamed onward through open water, and hopes ran high of reaching new lands beyond Inglefield's farthest of 1852.

But after penetrating about forty miles the formidable unbroken ice of the previous winter rose up ahead, presenting an impassable barrier across the sound. It was a keen disappointment to be turned back thus on the threshold of the unknown; but, with no prospect of changed conditions, and with definite responsibilities ahead of us, protracted delay in these inland waters seemed unwarranted.

At noon on August 10 observations showed our position to be: Lat. 76° 14′ 53″ N., long. 81° 52′ 36″ W. Earlier in the day we had reached a point ten or fifteen miles west of this, where the solid floes extended across the sound. Holding our course to the northeast along the edge of the ice, we passed Cone Island at 4 P. M. This conspicuous landmark is apparently composed of red sandstone and rises in pyramidal outline directly from the ice-flecked waters of the sound.‡

* Clements R. Markham, P.R.G.S., in an address before the Royal Geographical Society, on May 28, 1894 (Geog. Journal, vol. iv, p. 14), referring to the possibilities for original research in Ellesmere Land, remarked: ". . . Next to northern Greenland, the most interesting part of the unknown region is the land on the western side of the north part of Baffin Bay, between Smith Sound and Jones Sound, and extending along Jones Sound to the west and north. It was named Ellesmere Land by Sir Edward Inglefield, who saw it from the deck of the Isabella in 1852. It is called Uming-Mak (the land of the musk oxen) by the Eskimos. No one, so far as we know, has ever landed between Jones Sound and Smith Sound."

† A few ancient Eskimo graves were found at Cape Faraday.

‡ On August 17, 1851, Lieut. Sherrard Osborne, in the Pioneer, reached about the same position in Jones Sound and found like conditions prevailing, as he writes: "From a little beyond a conical shaped island on the north shore the sound was still barred with floes." Two of his officers landed on Cone Island and reported finding "numerous Eskimo traces, though of very ancient date." (Stray leaves from an Arctic Journal, New York, 1852, p. 187.)

Wishing again to set foot on this land, which had promised such great rewards to our efforts, we steamed past Smith Island and headed our vessel toward a small bay on the adjacent north shore of the sound. After scrambling over the broken ice for two hours, we reached a smooth beach at the mouth of a small glacial valley. Rambling among the rocks where beds of scarlet saxifrages smiled a welcome, we disturbed a few eider ducks feeding along the shore and sent two Arctic hares scampering up the hillsides. These were the only living things observed, although the skeletons of an ice bear and seal and numerous whale vertebræ were found embedded in the sand near the beach. We were at a loss to account for the presence of these bones until the interesting discovery was made that we had lit upon the site of an Eskimo settlement. The foundations of eight igloos were found and a search amid the soil disclosed part of a bone sledge runner and the fragment of a lance head of the same material. These remains had every appearance of great age.

Bjorling, in his record dated October 12, said that after the wreck of the Ripple he tried to reach Foulke Fiord to winter there, but "after reaching Northumberland Island, was compelled from several causes to give up this voyage and return to Cary Island." Thinking that possibly some traces of the presence of the Swedes might be found on this island, we skirted the south shore and landed at one point, but nothing was found to throw any further light on their movements.

After leaving Northumberland Island, we visited the native village of Netiulume, on the mainland to the southeast, where some hours were spent in securing ethnological specimens, after which we again started for "Anniversary Lodge," 75 miles distant. But our old enemy the solid bay ice, which baffled us so often during the summer, so delayed our advance that it was seven days later (August 20) before we cast anchor in Falcon Harbor, in front of "the Lodge."

On August 26 Mr. Frank W. Stokes and Mr. E. B. Baldwin, the artist and meteorologist, respectively, of the Peary party, came on board. Their companions of the previous winter, Dr. E. Vincent and Messrs. Astrup, Entrikin, Clark, Carr, and Swain, had accompanied us to Jones Sound and were already established in their contracted quarters on the Falcon. Last of all, Mrs. Peary and her infant daughter and Mrs. Cross, the nurse, came on board, together with Miss Bill, a young Eskimo girl, whom it had been decided to bring to the United States. Hearty farewells were spoken to Mr. Hugh J. Lee, the member of Lieutenant Peary's party who had volunteered to remain over another winter with him, and then our stanch old craft raised anchor and began her homeward voyage. Lieutenant Peary had decided to accompany us as far as Cape York.

At the Petowik Glacier the lieutenant bid farewell to his devoted wife and infant daughter and clambered down into the whale boat, which with its crew of Matt Henson, the colored servant, and four Eskimos, was awaiting him. Decked out in all her bunting, a salute from her gun proclaimed the farewell of the Falcon.

Erect and resolute in the stern of his small boat, Lieutenant Peary, in answer to the parting cheers from the ship, waved a farewell as the favoring wind bore him from our sight. A strange parting this—under the cold, gray sky of the Arctic—with the great glacier in the background.

Keeping in the open water of Melville Bay, we set our course for Godhavn, on Disco Island.

Our last stop in Greenland was made at Godthaab, the capital of South Greenland, where the Danish officials extended every courtesy to us and where, during our two days' sojourn, we enjoyed the opportunity of observing many phases in the life of this happy but isolated community. Leaving Godthaab on September 8, an uneventful voyage of seven days brought us once again to the familiar harbor of St. Johns and into touch with the great world beyond.

[From Science.]

THE ARCTIC EXPEDITION OF 1895, AND LIEUTENANT PEARY'S WORK.

The North Greenland expedition of 1895, s. s. Kite, the primary object of which was to bring Lieutenant Peary and his companions back to the United States, left St. Johns, N. F., on July 11. At this time the members of the party were Mr. Emil Diebitsch, Dr. J. E. Walsh, Mr. Theo. Boutillier and the writer. A little later we were joined by Prof. L. L. Dyche, who had preceded us to the coast of Greenland. The chief scientific work undertaken by members of the party was the collection of birds and mammals by Prof. Dyche and the study of glacial geology by the writer.

After brief stops at Holstenberg, Godhavn, Jakobshavn, Atanikerdluk, and Dalrymple Island, Inglefield Gulf, or perhaps more properly Whale Sound, was reached on the morning of July 31. To this point, but little floe ice had been encountered, even Melville Bay being essentially free from it along the line of our route. In Inglefield Gulf, twenty-five miles or so from Mr. Peary's headquarters, the ice stopped further progress. From the natives who soon boarded the Kite from the settlement of Karnah, it was learned that Mr. Peary had returned from his journey across the inland ice, and that he, together with Messrs. Lee and Henson, was now at the lodge at the head of Bowdoin Bay. After an unsuccessful attempt to reach the head of the bay by crossing the ice on dog sledges, the lodge was reached on August 3, after an overland journey from the head of McCormick Bay.

The main facts concerning the work of the year were soon learned. The provisions which had been cached on the ice cap for the trip of 1894, not being used that year, were relied upon for the journey of the succeeding season. In September of 1894, after the departure of the Falcon, an attempt was made to visit the nearer caches. One of the objects of the visit was to get the provisions out from beneath the season's snow; so as to make them more accessible when the journey of the following spring should be begun. Although the same caches had been visited in the preceding July and the provisions then raised to the surface of the snow, it was found in September that the snowfall of the summer had been so heavy that neither of the two caches nearest the border of the ice could be found, the signals having been completely buried. After this discovery, little hope was entertained that search for the caches would be more successful in the following spring. As the caches on the ice contained the pemmican, which was to have been the chief article of food, and the alcohol which was to have served as fuel, Mr. Peary was obliged to face the prospective loss of both. With this unpleasant outlook, the winter was passed.

Instead of giving up the proposed journey across the ice cap, Mr. Peary made such provision for the trip as was possible, and on April 1, accompanied by Lee and Henderson, started for Independence Bay. As had been expected, the important caches were not found. In spite of this the crossing of the ice cap was successfully accomplished, the distal edge being reached on May 13. The rest of the month was spent on the land about the bay. From lack of provisions a longer stay was impracticable, and the return journey across the ice was begun on June 1 and ended on the 25th.

The enterprise and courage with which Mr. Peary conceived and attempted to execute his plans would seem to have entitled him to more consideration at the hands of the powers that be. On two successive years his well matured plans have been thwarted by circumstances over which he had no control, and upon which he could in no way count.

While adverse circumstances have made it impossible for him to carry out, in full, his plans with reference to the north coast of Greenland, he has nevertheless accomplished much during his Arctic residence. He has twice (in 1892 and 1895) crossed the ice cap from Inglefield Gulf to Independence Bay, and has gathered information concerning the inland ice and the ice-free territory beyond, which possesses unique value. Further he has mapped a considerable stretch of the coast of West Greenland, in the vicinity of his headquarters. The full value of this work will first appear when the map is published, but a few general statements concerning it will indicate something of its scope. It covers the coast from Cape Alexander (lat. 78° 10′) on the north to Cape York (lat. 75° 55′) on the south. Within this latitude the range in longitude is nearly 8°. The coast is very irregular, as may be inferred from the fact that its actual length, including the islands near the mainland, is about 1,000 miles. A comparison of Mr. Peary's MS. map with the earlier charts of the same region reveals the extent and the importance of the changes, which are so great as to make it apparent that the new map is really such, and not merely a corrected copy of the old. The modifications are so extensive that, were it not for the names, the new map and the last edition of the chart of the same region, issued by the Hydrographic Office, would be taken to represent the same coast. In some places the general trend of the coast is altered many degrees. Many bays are mapped which have not hitherto found representation, and many indentations of the coast which have heretofore appeared upon the charts have been changed in position and size. Eleven islands which do not appear on the published charts referred to have been accurately located, and the position, shape and size of those heretofore represented have been corrected. A large number of glaciers, probably as many as 100, have been located with approximate accuracy within the region where but ten were represented on the published chart, and even these were in some cases in false positions, and greatly exaggerated in size. Astrup's map of Melville Bay, already published, should be mentioned in this connection, since it was prepared while its author was a member of Mr. Peary's corps. Geographers will not fail to appreciate the magnitude and the importance of this cartographic work.

In addition to the map, Mr. Peary has kept a series of meteorological records, probably the most accurate and elaborate which have ever been secured in so high a latitude. Besides the more formal records, he has been observant of the behavior of winds about the ice sheet, and in this way has come into possession of facts which are not without significance in connection with the problems of glaciology. He has made careful measurements of the rate of motion of one of the most active glaciers of the region, and has carried them through a sufficiently long period of time to give them especial value. He has brought back two large and choice meteorites from the coast east of Cape York, the study of which will possess much popular as well as scientific interest.

In quite another line, important studies have been prosecuted to a successful issue. During his three years and a half of Arctic residence—adding the time of the earlier visit to that of the later—Mr. Peary has made a study of the Eskimos of North Greenland. During this time he has personally come into contact with almost every man, woman and child on the west coast north of the Danish possessions. He has lived among them in such a way as to get from them data which no temporary visitor could secure, and which no one, not understanding their language, and not commanding their confidence, could hope to gain. As a result, he is in possession of much fuller knowledge of these people than any one else has ever been. The results of his study, when published, will be an important contribution to ethnology.

Indirectly, the expeditions which Mr. Peary has caused to be made into northern waters have not been without result. Five successive voyages, without accident, have shown that Arctic navigation, under proper management, is not so dangerous as has been supposed. Through those who have accompanied these expeditions, much information has been secured touching the natural history, the geography and the geology of the regions visited. Some of these data have been published, while others have not yet appeared, but they must nevertheless be taken into account in enumerating the results of the several expeditions for which Mr. Peary has been responsible. It will readily be seen that returns are, in the aggregate, very considerable, and that, although the object which was first in mind when the last expedition was planned has not been fully attained, the results which have been achieved cannot be looked upon as incommensurate with the outlay.

So far as concerns the results accomplished by the members of the party of 1895, it may be said that Professor Dyche was successful in getting large numbers of birds and mammals at various points along the coast. He was especially fortunate in securing an abundant supply of walruses, both bulls and cows, goodly numbers of reindeer and seals, and a smaller number of narwhals.

The writer saw much of the west coast of Greenland between latitudes 64° and 78° 45′, at close enough range to study its geographic features to advantage. Stops were made near the parallels of 67°, 69°, 70°, and at many points between 75° 45′ and 77° 45′. At all these points geographical and geological studies were carried on. The eastern coast of America was also seen for a considerable distance, especially from Ellesmere Land south to 71° 30′, and most of the coast of the island of Disco. On the Greenland coast many glaciers between 75° 45′ and 77° 45′ were studied in detail, and some determinations of significance concerning glacier motion made. A considerable body of evidence was gathered touching the former extension of the ice cap of Greenland. Determinations were also made at several points concerning recent changes of level of the land. Rollin D. Salisbury.

University of Chicago, October 4, 1895.

THE ASCENT OF KILAUEA.

By Edward Everett.

On February 24, 1890, a party left Honolulu on the steamer W. G. Hall to make the volcano excursion. This boat pursued the southern or leeward route, and landed us at Punaluu, on the southeast side of the island of Hawaii, about 6 P. M. next day. We were rowed ashore through a foaming sea, to a landing in a nook between jagged rocks over which the sea was wildly dashing. A nice hotel provided us with a good supper and lodging. Some apology is necessary for here offering an account of an excursion which was made five years ago, at an unfavorable time as regards the state of activity of the volcano, and on which I saw far less than is usually seen by visitors to the crater of Kilauea. Unfortunately at the time of my visit the crater was in its least active state, and the great fiery lake of Halemaʻumaʻu was said to be out of business for the time, or as otherwise expressed "the bottom had fallen out." Owing to the continual changes in the condition of the volcano, every successive observer sees some different manifestation of its forces. The visitor on viewing for the first time these wonderful displays is dazzled and confused by what he sees, and it is only by much subsequent study and reflection that he can in part comprehend the phenomena underlying the action he witnesses.

But what I saw of Kilauea and afterward of the great extinct volcano of Haleakala on the island of Maui stimulated my desire to learn more, and has induced some speculation as to the peculiar features and the causes of the phenomena exhibited. Having myself realized, on the excursion herein described, the need of explanatory information, which is only to be obtained by prolonged investigation or by attentive perusal of voluminous scientific works, I add to my narrative of the trip, without pretending to any complete elucidation, some important facts gathered from the works of Dana, Brigham, Judd and others, together with some remarks which have suggested themselves to my mind.

The following morning after breakfast, we left by a narrow (2 foot) gage railway, on our way up the mountain. This took us about 6 miles to a large sugar plantation, for the use of which the road was built over a rough and broken field of lava. Here we were transferred to carriages, one drawn by 6 horses and the other by 4 mules. We had a comfortable journey up the gentle ascent of the mountain 23 miles to the Volcano House, at an elevation above the sea of 4,040 feet. There was no abrupt ascent, and little noticeable steepness, except in uneven places, and when up, there was no appearance of excessive height, except that the temperature was much cooler.

The way was over lava fields in a more or less decomposed state, some having been converted by age and the elements into rich soils, with luxuriant vegetation on them, while other and fresher flows showed little sign of wear since their rough surfaces and upheaved masses were left to cool. In tracks where wild grasses and various vegetation had taken possession, tame and wild cattle find a living, but a precarious one, for in dry times they starve, and suffer for want of water. For the character of the lava flow is such that large caves and channels are formed by the cooling of a firm crust on the surfaces, while the hot lava flows on below, leaving arched sewers which conduct the rainfall to the sea, wholly underground. Near the crater the vegetation increased in beauty and abundance.

We arrived at the Volcano House between 4 and 5 P. M. The approach to it was near the brink of the crater, and between it and huge sulphur beds emitting dense vapor, which added to that proceeding from numerous steam cracks in the vicinity, rendered the atmosphere of the neighborhood exceedingly damp. Some of the party went across the crater to the burning lake after our arrival, and returned about 11 P. M.

The majority of the party waited till the next day, and at 3 P. M. descended into the enormous crater of Kilauea, which may be described as a long irregular oval, the floor of which has apparently sunk to its present level at a depth of 500 to 600 feet below the edges, which are in general vertical walls or cliffs. The dimensions are 3 to 4 miles long and 2 to 3 miles wide, with a circumference of 9 miles, more or less. The descent was by a winding path on rocks which had fallen away from the side of the precipice. The distance from the hotel to Dana Lake, at that time the only active part of the volcano, was stated to be 3½ miles, and we judged it was not overstated. The descent to the floor of the crater was counted as one mile, and the path was easy, that is, going down and was flanked by luxurious vegetation, tree ferns, ohias, sword grass and other elegant growths, which ceased suddenly as we reached the black lava at the bottom.

From thence the way led over the most desolate region imaginable. The lava lay as it had cooled, with cracks caused by its shrinkage, from an inch wide to a foot or more, some of considerable depth, and many of them emitting steam and sulphurous vapor. The plain was very uneven, and piles or hummocks of cooled lava 10 to 20 feet high, apparently the result of some outburst, were not infrequent. There were also

basins deeply depressed, which were probably the sites of former active lakes.

The locations of activity are said to be constantly changing, as well as their degree of intensity, and every description varies from those given before. Much of the lava is hollow underneath, owing to the liquid lava having flowed from under that which had cooled at the surface, and there are pipes and channels thus formed which, being cracked and broken, make difficult and dangerous walking. The endless variety of forms assumed by the lava require photographs to give any idea of them. Long rolls like tree trunks, wrinkles, sometimes like great shells, old ropes in great abundance, and heaps, like magnified worm casts, are a few of its forms.

Occasionally you come to broken-up lava in heaps or ridges, and it was in surmounting some of these latter that we encountered dense sulphurous fumes, and in the struggle through these, especially on the return trip, when having to climb a considerable elevation over the sharp and jagged edges of a broken-up ridge of lava, with one's nose and mouth partially stopped by a wet sponge or handkerchief tied on, as was necessary to prevent suffocation by the sulphurous acid, it was difficult to meet the extra demand for breath which the exertion required. One of the ladies was overcome by the difficulties of this place, but was dragged through by the guides.

A little beyond this place we came in sight of the Burning Lake. It was at the foot of a rugged descent, the crater here having changed its generally level character for rough cliffs and broken masses of rock and lava. We found seats on blocks of lava, where we could conveniently look down on the fiery lake, from a height above it of 50 or 60 ft., and perhaps 200 ft. from it. It was in form an irregular oval, of about 200 ft. wide and 400 or 500 ft. long. I changed my position for part of the time to one much nearer, and found a convenient point of observation. The dark grayish surface of the lava lake lay nearly motionless before me. Its color would have been a low red, if not contrasted as it was with the white hot light of the boiling lava adjacent.

Immediately in front on the opposite side of the lake was the scene of greatest activity. Lava boiled up from below, throwing columns of the incandescent material occasionally to the height of ten feet or more above the surface of a semicircular space in the lake which was kept open by the violent surging to and fro of the lava for the time in action. The mass of lava thus thrown upward at one time might be estimated without exaggeration at many tons. It had, after rising, a forward-flowing motion, subsiding again into the lake, much like the motion of water boiling violently in a caldron. This ebullition was accompanied by profuse discharges of sparks or small ignited masses which fell upon the partially hardened lava in front.

Frequently small quantities of the white hot liquid were thrown to a greater height, and falling against the dark background of the perpendicular rock behind, stuck to it and there slowly cooled. This gave rise to a series of figures in great variety; the semblance of ducks, swans, snakes and ghostly forms of animals and human beings were projected on the rock, at a white heat, slowly turning to red and then fading out in the glare, or their places were taken by other forms. Once, when we were all looking on, a spectral figure of a girl clad in long robes rose from the hottest portion of the lake, and, throwing out an arm, appeared to grasp a projecting point of rock and cling there, where she hung in the supplicating attitude seen in the well known picture of the Rock of Ages.

No wonder that this crater has given birth to numerous myths and superstitious legends.

Another similar point of activity was on the right at the end of the lake, which occasionally threw large jets of lava into the lake in front of it. It had formed a hollow half dome above and against the bank, and while still within fifteen or twenty feet of this lava fountain, I was protected by this screen from the direct heat and glare, as well as from the sparks which were constantly being thrown out.

I here gained a personal knowledge of the nature of these pyrotechnic projectiles and of the manufacture of the so called Pele's Hair, in the following manner. I found the bank on which I was reclining to be composed in large part of that substance, mixed with nodules of black glass. Endeavoring to collect some of the former for specimens, I found my fingers stuck full of needle-like particles of glass, and then on moving slightly discovered that my clothes were likewise stuck full of similar pointed arguments, which soon convinced me that my hitherto comfortable and advantageous seat was no longer tenable. I thus learned that the fine threads, like spun glass, soft and matted together so that the birds use it for lining their nests, and said by the natives to be the hair of the goddess Pele, were the long drawn out tails of particles of black volcanic glass, which melted material seems to float on the surface of the lava, and is blown into the air by gas or steam escaping violently therefrom. The particles have a tendency to form a sharp tapering tail ending in the fine hair-like thread. They are blown on the rocks in large quantities, and the filaments alone go long distances and collect in cavities.—Boston Commonwealth.

THE HIPPELATES PLAGUE IN FLORIDA.*

By E. A. SCHWARZ.

DURING various trips to Florida in former years, I had opportunity to get acquainted with the annoyance caused by certain minute flies. They are justly dreaded by the natives and summer residents of that State, and generally designated by them with the comprehensive term "gnats." Mosquitoes and sand flies (Ceratopogon) are not more annoying in Florida in summer time than elsewhere, except near the coast, and the same may be said of the other annoying species of Diptera (house flies, horse flies and fleas). But these little "gnats," which prove to be certain species of the genus Hippelates, are during daytime constantly about you in swarms and render life more burdensome than any other insect pest.

When in July, 1894, I stopped for a few days at Crescent City, Fla., and visited, in the company of Mr. H. G. Hubbard, other parts of this State, I was more than ever impressed with the importance of these little tormenters, so that I fail to understand why in all our literature there is not even the slightest allusion to them. Since no one else seems to be willing to make a beginning, I have ventured to record the following fragmentary notes* for the sole purpose of drawing attention to this subject. Nothing is known at present of the life history or early stages of these flies.

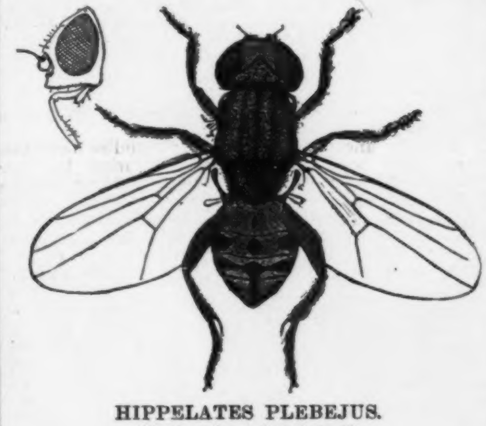
Since these flies cannot "bite," it may properly be asked wherein the nature of the annoyance consists and what renders them such an unbearable and dangerous nuisance. First they "sing" almost as perceptibly as a mosquito, and since every one is quite sensible to this well-known sound, it is, to say the least, not very pleasant to have these flies constantly around you. Secondly, they settle in crowds all over your person to suck up the perspiration, and the annoyance caused by their crawling over the face, neck and hands is much greater than one would expect from such small insects. But this kind of annoyance could readily be endured with a little patience and practice by all persons who are not of a nervous temperament

HIPPELATES FLAVIPES.
Much enlarged (original).

if the flies had not the pernicious habit and passion to settle in the corners of the eyes, being attracted by the moisture of this place. This causes the greatest and almost unbearable annoyance and irritation, which is, of course, still further increased by constant efforts to wipe the flies away.

The above relates solely to the annoyance caused by the Hippelates flies, but there are other facts which stamp them as one of our most dangerous pests: Sore spots, scratches, ulcers and other open wounds have the greatest attraction for them; they not only thickly crowd on such places which may be about your head and hands, but they crawl beneath your clothing if a sore or other wound should happen to be on your leg or breast.

If only your own person were concerned, the matter would present no particularly dangerous aspect, but look at the dog lying on the ground only a few steps from you. From flea bites or other causes he has suppurating sores on the back or belly, which, of course, are thickly covered with the flies. Unable to stand longer the irritation, the dog suddenly rises and shakes off the flies. You can plainly see that many of them come toward you and settle on your person, some of them sure to get in the corners of your eyes. Or, another person approaches you on the road: the man is plainly suffering from "sore eyes," a common disease among poor people in the South, or you happen to know that the person is afflicted with some other dis-



HIPPELATES PLEBEJUS.
Much enlarged (original).

ease. He is, of course, enveloped in a cloud of the Hippelates, and in passing him some hundreds of the flies now follow you.

If it has been proved that infectious diseases are disseminated by mosquitoes, house flies and other flies, the danger arising from the Hippelates as carriers of contagious diseases is, perhaps, more evident than in many other cases on record.† Mr. H. G. Hubbard, who has passed many summers in Florida, remarked on this point that "in Florida a serious disease of the eyelid is often prevalent. It is known as 'sore eye' and becomes absolutely epidemic from time to time." He feels certain that this Hippelates carries the disease, since it is well known that even the use of the same handkerchief will convey the disease from a sore-eyed person to a healthy one. He has known it to start with a single person and run through an entire school or community; and he thinks Hippelates alone accounts for the rapid spread. Moreover, the irritation caused by the flies greatly aggravates the disease, which becomes very serious, the patient seldom recovering entirely from it, being affected by weak eyes ever afterward.* This danger of diseases being carried by the flies exists not only between man and man, but also among domestic animals and between man and animal.

Geographical Distribution.—The Hippelates plague reaches, in my experience, its maximum height in Florida, but I also encountered the flies in annoying numbers at Selma, Ala., and Columbus, Texas. Mr. L. O. Howard observed, some years ago, swarms of a small fly greatly annoying his dog, in the vicinity of Washington, and fortunately collected and preserved specimens; finally, Mr. C. L. Marlatt reports a similar experience near the same place. The meager material thus collected was submitted to Mr. Coquillett, and was found by him to represent three species. The species from the District of Columbia collected by Mr. Howard, H. flavipes, Loew, proved to be identical with that observed at Crescent City, Fla., and, judging from memory, the same species occurs at Selma, Ala. Specimens collected at Bartow, Fla., were determined by Mr. Coquillett as H. pusio, Loew, while those found by the writer at Columbus, Texas, and by Mr. Chittenden at Rosslyn, Va., proved to be H. plebejus Loew. It is safe to assume that other species of the same genus will be found to possess the same habit; but since these small flies have never been carefully collected, nothing definite is known at present regarding the geographical extent of any of their species. All that can be said at present is that the genus Hippelates seems to be confined to the more southern portions of the country.†

It is not the object of this note to enter into a description of the species of Hippelates mentioned above. They are carefully described by Loew in his "Centuriæ," and the characteristic features of two species (H. flavipes and H. plebejus) are well set out by the accompanying illustrations, which were drawn by Miss L. Sullivan, under supervision of Mr. Coquillett. It suffices to say here that in form of body, general appearance, and mode of locomotion the Hippelates resemble our common house fly, but they are much smaller than the latter, averaging not more than about 1·75 mm. in length. In spite of their small size they are, when alive, quite conspicuous by the bright color of the legs and of a part of the abdomen, which, in the case of H. flavipes and H. fusio, strongly contrast with the brilliantly black color of head and thorax. In H. plebejus almost the entire abdomen is yellow, but the forepart of the body is opaque and grayish. A peculiarity of Hippelates is the hardness of their bodies, and a slap with the hand which would be sufficient to crush any mosquito or house fly does not hurt them in the least.

Notes on the Habits.—The flies are strictly diurnal, and continue to be troublesome from early morning till near sunset, being most aggressive during the hot and sultry hours of the afternoon. They preferably frequent open and sunny places, while in the shade of dense forests their presence is not noticeable. They are equally troublesome in the open country away from human habitations and in the streets of small towns, but I do not recollect having seen them in any number on the streets of the larger cities. They enter the houses, but evidently do not feel at ease in the rooms, for they do not attack people, but congregate on the panes of the windows if these happen to be closed. When not on the wing the flies can be seen sitting on the leaves of trees, shrubs, and all sorts of lower plants, the exuding sap of which probably constitutes their natural food. Neither in Florida nor at other places in the South did I notice them near the ocean shore, perhaps because they are unable to endure the constant breeze. It is further my experience that the flies are exceedingly abundant only wherever the soil is sandy; they are either entirely absent or hardly noticeable in regions where the soil is rich and heavy. During the month of August I traveled through the "black land" region of the cotton States, and was annoyed by the flies only at two places, viz., in the suburbs of Columbus, Tex., where the soil is dry and light, and at Selma, Ala. At the latter place not a single specimen was to be seen on the right side of the Alabama River, where the soil is black and heavy, while just across the river, where it is sandy, the flies were almost as bad as I have experienced them in the interior of Florida. Persons visiting or residing in Florida during winter or early spring are not molested, the flies at this season being either not numerous enough to attract attention or they are not aggressive. Mr. Hubbard says that they commence to be troublesome when the weather gets really warm, or about the month of May. In July, with the beginning of the rainy season, they are out in full force, but how long they continue to torture man and animals has not been ascertained.

Life History.—As stated above, we know nothing thus far of the earlier stages of the genus Hippelates. The records‡ of the larval habits of other genera of the family Oscinidæ show that the larvæ of the majority of them breed in stems of graminaceous plants. It is possible that Hippelates has the same habit, but Mr. Hubbard remarked that "if the insect is really an above-ground leaf miner or stem-miner, its work would have been noticed by him, as, on account of the great number of the flies, the work of the larvæ must be very extensive and readily seen." The records further show that some other Oscinid larvæ breed in decaying stems of plants, in worm-eaten nuts, and under the bark of old trees, and Mr. Marlatt suggests that "the attractiveness of the moisture of the eyes and of sores would indicate that the larva is perhaps saprophagous in its habits, and may be found in decaying vegetation."

The sandy regions of Florida, where the Hippelates

* From Insect Life.

* These notes were read before the meeting of the Entomological Society, of Washington, held October 11, 1894. Several members of the society participated in the discussion, and some valuable additional information was thus obtained, which is included in this article.

† The literature on the subject appears to be quite extended, but is not readily accessible. Most of the articles which I was able to consult deal with the dangers arising from house flies and mosquitoes, but it is evident that the writers on the subject of ophthalmia refer to other species of Diptera, though no names are given.

* Proc. Ent. Soc., Wash., vol. iii, p. 179.

† Osten Sacken's Catalogue enumerates two species from Texas, one from the District of Columbia, one from Illinois, four from Cuba, and one from California. The latter locality is open to doubt.

‡ As collected by Brauer (Die Zweiflugler d. k. Hofm. Wien, part 3, pp. 84, 85), and Townsend (Can. Ent., 25, 1893, p. 14).

flies occur most numerously, are for the most part covered with open pine woods, and their chief characteristics consist in numerous smaller or larger ponds and lakes which are usually surrounded with a belt of rushes and reeds. From this feature of the country I am inclined to believe that the Hippelates larvæ will be found to live either within the stems of the living reeds or under or within the piles of the decaying reeds which usually line the shores of the lake.

Remedies.—Until some light is thrown on the life history of the flies, it is impossible to suggest any remedial measures to be adopted for the general abatement of this pest in a given region. Very little can be said regarding protective measures. To kill the flies as we instinctively do the mosquitoes, by a slap of the hand, is of no avail against the Hippelates, because they are too numerous and for obvious other reasons. A close-fitting veil would no doubt protect the eyes, but in the hot days of a southern summer the wearing of a veil is a torture almost equal to that of the flies. For the same reason applications of oil of tar, oil of pennyroyal, and similar substances, which are more or less satisfactorily used in the North against mosquitoes, black flies, and sand flies, is hardly bearable in the South. Smoking cigars or a pipe offers good protection to those that indulge in this vice, but even an inveterate smoker cannot smoke constantly when he is outdoors. A good smudge also drives away the flies, but, of course, can not be classed among the remedies that are handy and available at every hour and at every place. Sprinkling the coat collar and other parts of the clothing with Eucalyptus oil (and no doubt, also, other strongly smelling etheric oils), as lately recommended as a good repellant against house flies, should be tried, and promises, in my opinion, good results.

POISONING FROM COWBANE.*

(Cicuta maculata, L.)

By L. H. PAMMEL.

COMMON names: Water hemlock, spotted cowbane, musquash, root or beaver poison.

The cases of poisoning from eating the root of cowbane (Cicuta maculata, L.) are not infrequent in the State of Iowa and elsewhere. It affects man, cattle

1.—Fascicled roots of cowbane, slightly reduced. Young stems coming out near the top. At (2) cross section of root. At (3) longitudinal section. Drawn by Charlotte M. King.

and horses. Every now and then there are accounts of poisoning from "wild parsnips" in our papers. The writer has at various times received communications with specimens of "wild parsnips." The subject is of considerable interest, and especially so because the plant is widely distributed in Iowa, and a large number of people are not aware of the poisonous nature of the root. Spotted cowbane is a member of the carrot family, or as it is known botanically, Umbelliferae †

The family contains many important plants like the carrot, parsley, celery, valued for their food, while others, like the caraway (Carum carui), lovage (Ligusticum), anise (Pimpinella Anisium), asafetida (Ferlua Narthex and F. Scorodosma), coriandrum seeds (Coriandrum sativum), have aromatic properties and are used for culinary and medicinal purposes. Others, like poison hemlock (Coniuam maculature), are used in medicine. This plant and our cowbane are deadly poisonous. The former species has been used in medicine for centuries and it is supposed is the plant mentioned by the Greeks to execute Socrates, Phocion and criminals.

The plant is naturalized in Eastern North America, but is seldom met with in Iowa. It is a coarse biennial with spotted stems, large decompound leaves and white flowers.

SPOTTED COWBANE, MUSQUASH ROOT, BEAVER POISON. (Cicuta maculata.)

It is a smooth marsh perennial 2·5 feet high, with pinnately compound leaves 2-5 times pinnate; the leaves have long petioles, the coarsely serrate leaflets are lanceolate to oblong lanceolate 1·5 inches. Stalk of the umbellets numerous and unequal. Flowers white, fruit broadly ovate to oval small 1¼ lines long. Grows in marshes and in low grounds. See Plate 1. The stems spring from thick, fleshy underground roots that taper at the lower end. These usually number from three to five, but single specimens are also met with. On cutting the roots a sharp, pungent odor is given off, intensified on boiling.

The bulk of the root is made up of the cortex. It contains large parenchyma cells with numerous small intercellular spaces. It is also provided with large intercellular spaces* in which the resinous product is found. This product is secreted by the surrounding cells, which are minutely granular. These canals are either filled or contain large drops of resin. This product is soluble in alcohol, hot water, alkalies and acids. The poison exists in this resinous product. Auken † has shown that the active principle is a resinous indifferent substance to which he gave the name of cicutoxin. Bohm, ‡ who obtained the principle in a pure condition, Cicuta virosa, states that it is a thick, tenacious substance with a disagreeable odor. The dry root gives about 3·5 per cent., while the fresh 2. Wittstein and Buignet found a volatile alkaloid called cicutine which, according to Cimon, is not poisonous. On the other hand, an alcoholic extract of the dried root operated as a violent poison on animals. The active principle, whatever it may be, is found in resinous product occurring so abundantly in the resin passages of the parenchyma zone.

The parenchyma cells are large with numerous intercellular spaces; these contain minute granules. As determined by the section of agricultural chemistry, these granules consist of cane sugar.

This accounts for the sweetish taste of the roots. The medullary rays project into cortex, and these cells also contain starch.

It may be of interest to review some of the cases which have come to my notice.

In 1893 the writer received from Eugene Brown, of Mason City, in Cerro Gordo County, some root of the so-called "wild parsnip," which had poisoned three boys respectively five, seven and nine years of age. The cases recovered. The specimens sent me proved to be cowbane (Cicuta maculata). §

The following note by Professor A. A. Crozier is of interest: "Hon. Eugene Secor, of Forest City, this State, a member of the board of trustees of the Iowa Agricultural College, brought me to-day a fleshy root of a plant of the water hemlock (Cicuta maculata, L). The circumstances which brought it to his notice were as follows: A neighbor of his by the name of Mr. Oleson, a farmer of about fifty years of age, while dragging some potato ground upon bottom land about two weeks ago, discovered one of the fleshy roots of this plant, and supposing it to be an artichoke, ate it and gave a portion of it to his two sons. He soon began to feel queer or 'funny,' as he expressed it, and went to the house, where he was taken with a spasm, followed by two or three others, when he became unconscious and within half an hour, before a physician could be summoned from the village, two miles distant, he was dead. The children had probably eaten less of the root, and being given an emetic, recovered. The plant is very common in the State and the roots are so pleasant to the taste to make it particularly dangerous. I may add that I ate a piece of the root the size of a filbert with little or no unpleasant effect."

The following from Mr. A. M. Illias: ¶

RUTHVEN, IOWA, January 12.

Professor J. L. Budd,
Iowa Agricultural College, Ames, Iowa.

I mail herewith a small paper box which contains some weed, of which I sent you a specimen last summer. This species of hemlock, as you call it, I picked out of a manger of a stallion, which took suddenly sick this morning. Sickness lasted but a short spell. Do not know whether this had anything to do with his sickness, but am terribly prejudiced against it. Another instance a few days ago of a colt taking violently sick all at once, apparently no cause, there being considerable of this weed in the hay, and I had two cows lose their calves a short time ago; cows had access to this kind of hay. This quite frequently occurs hereabout. On a neighboring farm where this weed abounds they lost nearly all their calves two years ago, apparently no cause, but, of course, there is a cause somewhere. I am satisfied some stock will eat the leaves of this weed. If you can ascertain by this sample whether it will harm stock to eat it, would be pleased to have you answer it either by letter or by your writings in the Register, of Des Moines. Of course, I do not know whether this weed will harm stock if eaten by it, simply make these suggestions for your consideration.

The specimens were turned over to me and I replied in a short note in Register, mentioned its poisonous qualities.

I also insert the following interesting letter from J. A. Minteer:

Experiment Station,
Agricultural College, Ames.

Gentlemen: I have just had a strange experience with my cattle, having lost a four year old cow and a yearling calf. I think that they were poisoned on some kind of weed root found in the slough. I locate it on a spot where a hay stack stood about two years ago. It had been removed except the spoiled hay in the bottom. Last fall being dry, I pitched it up, dried and burned the old hay, sowed rye and timothy seed, ran the disk harrow over several times and noticed that we turned out lots of roots like small sweet potatoes, except that they were all connected at the top. I thought they were the root of a weed that grows a stalk similar to a seeded parsnip, have a strangly top similar to an elderberry when in bloom. The stock when mature is hollow. Now I am not certain that I am right about the top, as it had been mowed before I discovered the tubers. I never thought of them doing any harm; just thought we had torn them out, so they would die and do me no harm, but as the cattle, seventeen in number, were brought up Sunday evening they appeared to be all right until they came into the barn yard, when a cow fell down and seemed to have a spasm. It only lasted a few minutes, when she got up, walked about 100 feet and fell again, got up and walked about thirty rods, fell again and died in about thirty minutes. The yearling was all right until turned into the lot. In about twenty minutes she was taken in the same way, except a little more severe, rose two or three times, and died in about fifteen minutes. I was satisfied that they were poisoned, but the cause worried me for a while, then I remembered the tubers I saw in the slough. I went next morning before turning the cattle out and found that the cow and yearling had been eating some of the roots. I gathered up nearly one-half a bushel of the tubers, turned out the cattle and have had no trouble since. On opening the cows, I found considerable of the tubers in the stomach and the inside of the stomach was very black, and by scraping with a stick, I could scrape the inside of the stomach all off, as though it had been scalded. I will put a small piece of the stomach in the package with the tubers. Please let me know if the tubers I send are the deadly poison that I think they are, and how much of it is necessary to kill a cow. Some fall pigs have eaten some of the stuff from the cow's stomach, and it seems to do them no harm.

Prof. James Wilson informs me that a Mr. Hoover, of Traer, was poisoned by eating some of the roots of this plant. The following additional observations on a few cases of poisoning may be of interest:

Darlington* says: "The mature fruit of this plant has a strong anisate odor. The root is poisonous, and the lives of children and others are often endangered and sometimes destroyed by eating it in mistake of that of the sweet cicely (Osmorrhiza longistylis, D. C.) The herbage is also said to be destructive to cattle when eaten by them; all of which serves to show the importance of sufficient botanical knowledge among the people to enable them to understand and avoid or extirpate the evil."

Cowbane (Cicuta maculata), showing leaves, flowers and fruit. From the United States Department of Agriculture, Division of Botany. Slightly reduced.

Dr. Erwin F. Smith gives an account of a case of poisoning from this plant. He says as follows: "During the warm days which melted the snow and brought back the birds and gave indications of spring time, some children of a neighborhood on the outskirts of the city gave vent to their feelings by digging and eating some artichokes which grew upon some low ground bordering a brook. Two of these boys were taken violently ill, and one of them, eight years old, died within an hour after he had eaten the root." Dr. Smith states that upon an examination of the stomach and the root from which he ate, it was proved beyond a doubt that Cicuta maculata was the cause of death.

Lindley† says:

"A most dangerous poison resides in the roots of this plant; a drachm of the fresh root has killed a boy in an hour and a half, and in America fatal accidents arising from its being mistaken for other apiaceous plants are not uncommon. It has been used as a substitute for conium with similar effect, except that it is more energetic. A dangerous poison, producing effects similar to those of hydrocyanic acid. It appears to cause true tetanic convulsions in frequent paroxysms and death on the third day. Christison Haller considered it the conium of the Greeks. It appears to be fatal to cattle."

The following from Rafinesque: ‡ "Several persons searching for angelica root, sweet flag, sweet cicely (which all have a pleasant smell and taste) have eaten this root by mistake, and some have died in an hour's time. The effects of the poison were violent convulsions, a frothing mouth, a bleeding nose, dilated pupils, etc."

Robert Bentley § says: "Water hemlock or cowbane is another indigenous plant of a highly poisonous

* From Bulletin 28, Iowa Agricultural College Experiment Station.

† The order consists of herbs with alternate mostly compound leaves and flowers in umbels like the common cultivated carrot. The calyx or outer whorl of flowers is wholly adherent to the ovary. The limb of the calyx is obsolete or minutely five beaked. The five petals, inner whorl of the flower and stamens are inserted on the disk that covers the ovary. Ovary, two celled and two ovuled ovary. Fruit compound of two dry seed-like carpels.

* These are schizogenic balsam passages in which cells recede from each other where they meet at an early stage of the development of the plant.

† Journal Practical Chemistry, 1868, p. 105-151.

‡ Archi. f. Exper. Path., vol. v, p. 281.

§ Bulletin Torrey Bot. Club, vol. xx, p. 441.

‖ Botanical Gazette, vol. xiv, p. 17.

¶ Iowa State Register, January 21, 1891.

* Flora Cestrica, p. 104.

† Lindley, Flora Medica, p. 31.

‡ Rafinesque, Medical Flora, vol. 1, pp. 100, 110.

§ Man. Bot., third edition, p. 537.

nature, C. maculata, a native of America, has very poisonous roots, which, for having been mistaken for other harmless Umbelliferae, have not infrequently led to fatal results."

Dr. Masters says as follows of Cicuta virosa, to which our species is closely related: "This plant is dangerously poisonous, having qualities like those of conium; indeed, it is called water hemlock. It produces tetanic convulsions and is fatal to cattle eating the herbage. In April, 1857, two farmer's sons were found lying paralyzed and speechless close to a ditch where they had been working. Assistance was soon rendered, but the poor fellows soon expired. A quantity of the hemlock grew in a ditch where they were employed. A piece of the root was subsequently found with the mark of teeth in it near where the men lay and another piece of the root was discovered in the pocket of one of them, so that there can be no doubt that they were poisoned by eating the root of this plant by mistake for some other. The root of the American Cicuta maculata is even more virulent."*

Dr. Vassey † says concerning this plant:

"It is composed of a number of fleshy oblong portions diverging from the base of the stem, frequently as long and as thick as a man's finger. It has a strong penetrating smell and taste. It is often mistaken by children for the wild parsnip, or is supposed by them to be eatable, and every year the papers contain accounts of fatal poisoning from the use of the root. It is highly desirable that information may be diffused respecting this and other poisonous and deleterious plants, so that such accidents may be avoided. The root has been to some extent employed by medical men. Its effects are much the same as the European hemlock (no way related to the tree called hemlock in the United States), but it is now rarely used."

The following are symptoms from poisoning from spotted cowbane. Dr. Millspaugh, in his American Medicinal Plants, Fascicle 4, No. 67, has recorded the following observations concerning the physiological action of the Cicuta maculata:

"Many cases of poisoning from the root of this species have been reported, all showing by the symptoms that Cicuta produces great hyperæmia of the brain and spinal cord. The following case reported by letter to Dr. Bigelow ‡ by Dr. R. Hazeltine (1818) gives all the symptoms noted by observers in all the other cases. A boy had eaten of certain tuberous roots gathered in a recently plowed field, supposing them to be artichokes, but which were identified as the roots of Cicuta maculata. His first symptom was a pain in the bowels, urging him to an ineffectual attempt at stool, after which he vomited about a teacupful of what appeared to be the recently masticated root, and immediately fell back into convulsions which lasted off and on continuously till his death. The doctor found him in a profuse sweat and convulsive agitations, consisting of tremors, violent contractions and distortions, with alternate and imperfect relaxations of the whole muscular system, astonishing mobility of the eyeballs and eyelids, with wide dilated pupils, stridor dentium, trismus, frothing at the mouth and nose, mixed with blood and occasionally violent and genuine epilepsy. The convulsive agitations were so powerful and incessant that the doctor could not examine the pulse with sufficient constancy to ascertain its character. At the post mortem no inflammation was observed; the stomach was fully distended with flatus and contained about three gills of muciform and greenish fluid, such as had flowed from the mouth. This mass assumed a dark green color on standing."

Treatment.—In cases of poisoning from this plant emetics should be given promptly, anæsthetics and narcotics used to control the spasms. Dr. Hemphill, of Cerro Gordo County, reports to me that large doses of stimulants (whisky) greatly relieved the patients and aided in recovery. Lene and Falk also report that internal, external stimulants and the hypodermic injection of morphine aided in recovery.§

Prof. Henry Trimble, of Philadelphia, writes me that the general opinion of farmers in that locality is that it is very poisonous to cattle, and that one of the students found that the dried root had no effect on a cat, but when administered as soon as gathered it produced great uneasiness and vomiting in five gramme doses. The writer of this paper has eaten small portions of root on several occasions. The effects remained a long time, producing numbness in the mouth and pharynx.

SIAM GAMBOGE.‖

THE tree yielding Siam gamboge (Garcinia Hanburii, Hook. f.) is closely related to G. Morella, Desrouss., of Ceylon and Southern India. The former is a moderately large tree. The flowers are diœcious, the petals in both male and female flowers are fleshy and yellow. The fruit is the size of a crab apple, yellowish green when ripe. The tree is found on islands on the east coast of the Gulf of Siam, as well as on the mainland of Cambodia and Cochin China. It is from these localities that practically the whole of the gamboge of commerce is obtained.

Gamboge is a gum resin yielded by the bark of the two species above mentioned. It is a powerful cathartic medicine, but its chief use is as a pigment in water color painting. It is also used to give color to lacquer varnish for brasswork, etc. The most recent account of Siam gamboge is contained in a report on the trade of Siam for the year 1893, published by the Foreign Office (Annual Reports, 1895, No. 1,520). Mr. De Bunsen, Her Majesty's Chargé d'Affaires at Bangkok, was good enough to communicate to Kew specimens of the leaves of the gamboge trees, collected on the spot by Mr. Beckett, and although the material is not quite complete, there is little doubt they belong to Garcinia Hanburii, Hook. f. The extract from the report is as follows:

Gamboge is, next to gum benjamin, perhaps the most interesting of Siamese products. While gum benjamin is peculiar to a small belt of land in the north, gamboge is a resinous product, indigenous only in the islands and the sea coast of the Gulf of Siam lying between the tenth and twelfth degrees of north latitude.*

I recently had the opportunity of paying a visit to this part of Siam, and it may be of interest to describe the character of the tree and the mode of extracting the resin. The tree is known locally as "Ton Rong." It is found only in the islands of Koh Chang, Koh Kong and Koh Rong, and the mainland of the Indo-Chinese peninsula opposite these islands. The trees grow to the height of some fifty feet, and are straight stemmed, with no lower branches, owing probably to the dense shade of the forests in which they grow. None of those I saw had a diameter of more than 12 inches. Ten years' growth is said to be required before the tree is ready for tapping. This is carried on by the Cambodian and Siamese islanders in the rainy months from June to October, when the sap is vigorous, by cutting a spiral line round the trunk from a height of some 10 feet downward to the ground. Down these grooves the resin wells out of the bark and trickles in a viscous stream into hollow bamboos placed at the base of the tree, and from these it is decanted into smaller bamboos, where it is left for about one month to solidify. To remove the gamboge, the bamboo is placed over a red hot fire, and the bamboo husk cracking off, there is left an article known as "pipe" gamboge. The trees can be tapped two or three times during one season, and at the end of the season their trunks present a curious network of intercepting spirals. Care must be taken to prevent the rain water mixing with the resin in the grooves, as any mixture of water causes honeycombing and black discoloration, and a consequent depreciation of from 20 to 30 ticals (2l.) per picul in value.

The most valuable gamboge is that which is the least honeycombed or discolored, and is all the more difficult to obtain, considering the period of heavy rains during which the resin is extracted.

The bamboos contain on an average rather less than 1 lb. of gamboge, or about 170 bamboos to the picul. The price asked by the pickers themselves is at the rate of 2 ticals (8s.) for five bamboos full, and the local price is at the rate of 2 ticals (8s.) for three, or 65 ticals (4l. 18s.) per hundred, or about 8l. 7s. per picul.

The whole output is sold to local Chinese traders and taken by sailing boat to Bangkok.

GROUP OF LARGE CYPRESSES NEAR SCHIO, ITALY.

THE CYPRESSES OF SCHIO, PROVINCE OF VICENZA, ITALY.

WE figure herewith a group of cypresses found upon the estate of Mr. Antonio Bertoncello, at Santorso, near Schio, in the Province of Vicenza, and which are remarkable for their extraordinary size. These trees, which are four in number, are arranged in two lines that form a covered alley 65 feet in length. The first two, which are at the head of the alley, are about 110 feet in height and the smallest, which, as an offset, is more tufted, is 67 feet in height. The four together cover a surface of more than 1,200 square feet. The last, alone, covers a superficies of 430 square feet.

Tradition dates these trees back to the year 800. Although several centuries old and situated in a locality swept by winds, these four giants possess a very healthy vegetation, their leaves being always in a perfect state. The ground in which they grow is very dry, even after long rains, and does not produce a single spear of grass.—La Nature.

THE OLIVE IN CALIFORNIA.

THE fact that over 800,000 olive trees have been planted in California since this year began, and that olive nurserymen residing in several parts of the State have reason to believe that they will sell in the next ten months every one of the million or more of young olive trees they have grown for orchard planting, is evidence of the marvelous strides the culture of this fruit is making on this coast. In the years 1886, 1887, and 1888 the average annual planting of olive trees in orchards in this State amounted to less than 20,000 trees. Five years ago it was a matter of editorial comment in the journals of California when reports showed a total planting for that year of over 60,000 olive trees in this commonwealth. Three years ago Pomona Valley alone grew and shipped some 300,000 young olive trees, and in the last year has sent away to fruit growers in thirteen counties in California over 500,000 young olive trees from the nurseries.

Estimates of the acreage of olive orchards in this State put the number of acres of trees in full bearing at about 5,000 and the total olive orchard area at about 21,000 acres, valued at about $5,000,000. Last year the value of the crop in southern California and the oil product from the same are roughly estimated at $160,000, but as no effort has ever been made to get statements of the value of individual yields of olives in this region since the product became so important, these figures are but a rough estimate. Some dealers in olives and olive oil in southern California put the total value of the crop for 1894 at over $200,000. Reports from numerous olive growers in this part of the State in the past few weeks give reason to believe the crop of olives for this year will be larger than that of a year ago. The crop, taking tree for tree, will be smaller, but there are so many new orchards coming into bearing in all of the southern counties that the total amount will be larger than ever before. This is the "off" year for olives. The crop will be gathered in November and December, and the process of pickling the fruit and of extracting oil from the same will be in full blast when January will have arrived.

As in growing oranges, lemons, and other fruits, there are certain localities where each of these thrive to an unusual degree, and where more general and close attention is given to the culture of that particular variety of fruit. Thus, in the western part of Santa Barbara County olives have grown thriftily for some years, and the success of Ellwood Cooper in his olive groves has been the cause of extensive orchards of this fruit all over that locality. In Ventura County, which adjoins, the growing of apricots and prunes is carried on almost to the exclusion of other varieties of fruit. In the southern part of San Diego County the olive has also proved a marked success for fifteen years, and that region, too, has very large tracts devoted to olive orchards. In the past decade Pomona Valley, on the eastern edge of Los Angeles County, has become the most important olive depot in this county. Several men here have large fortunes invested in olive orchards, and there are hundreds of persons in Pomona Valley each of whom has an orchard of olives. The olive nurseries in the valley produce over three-fourths of all the olive trees grown in California, and, therefore, in the Union. The olive industry has grown to such proportions in a few years in Pomona that last season one man there made car load shipments of the pickled fruit. Seven years ago the whole crop in Pomona Valley might have been packed in several barrels.

There are in California but three mills for the production of olive oil from the olive. The largest is the Howland mill, at Pomona. It was built two years ago on plans from Italy, and much of the machinery and apparatus came from Leghorn, Italy. The Cooper olive mill, at Santa Barbara, and the Kimball mill, at National City, near the Mexican border line in San Diego County, were each pioneer olive mills and have been sources of large profit. So large has been the call for California olive oil since 1889 that the whole product has sometimes been practically sold ninety days after its extraction from the berries. It was formerly contended for years that the oil, adulterated with cottonseed and peanut oils and other ingredients, was so popular and cheap in the United States that the average person did not know the difference. The United States consuls in Italy and southern France have for years reported the arrival in their districts of cargoes of peanut and cottonseed oils for purposes of open adulteration of the olive oil products of those countries.

The age of the oldest olive trees in California runs back over ninety years. They are six in number, and stand about the San Gabriel Mission, still bearing fruit, living monuments to the wisdom of the Franciscan friars. The very oldest olive tree in the country is that at the Capistrano Mission, thirty miles south of Los Angeles. Its seed came from Barcelona, Spain, in 1769, and the purpose was to provide food from the trees for the monks, who came from olive-growing regions in the same latitudes as southern California, in Spain and the south of France. The old monarch has been photographed hundreds of times by tourists from the East. It is fifty feet high and has a trunk five feet in diameter.

The first manufacture of olive oil in California, outside of the Franciscan monasteries, was that at Comulus ranch, in San Buenaventura County, in 1871. The product was sold at a good profit to druggists and others in Los Angeles and Santa Barbara. In 1892 the production of olive oil had grown to 34,000 gallons, in 1893 it was about 50,000 gallons, and this year close estimates put the yield at about 75,000 gallons. The extent of the American market open to the California olive oil makers can be realized in the fact that the Department of Agriculture reports there are over 850,000 gallons of olive oil annually imported into the United States from Italy, Spain and France, and tens of thousands of gallons of olive oil, adulterated with peanut, cottonseed, and poppy oil, are sold every year in this country.

The Eastern people here often express wonder that olive growing in California has been so backward, considering that the adaptability of the fruit to this climate and soil was demonstrated by the Franciscan monks many decades ago. The principal reason is because of the former slow processes of propagating olive trees, and the many years that had to be spent in bringing the young trees to their bearing. People in the West, indeed all over the Union, do not care to give long years in preparing for a crop of fruit of any kind.

The present method of growing olive trees for orchard planting was not known until about 1883. The method of producing olive trees now in vogue among old fashioned European olive growers, and once common in California, is to cut limbs as large in diameter as a man's arm from trees, and from each of these start a new tree. An old olive tree will not furnish more than three or four such limbs for propagating

* Treasury of Botany, pl. I, p. 284.

† U. S. Department of Agriculture Report, 1884, p. 135.

‡ Bigelow, Amer. Med. Bot., vol. iii, p. 181.

§ Medical News, xl, p. 524.

‖ Kew Bulletin, June and July, 1895.

* The heavy rainfall of this coast seems necessary to the existence of the tree.

purposes. It will be immediately seen that the process is expensive, and limits the starting of new orchards to a few each year. Another method is the old fashioned planting of olive seeds. This is the slowest manner of making an orchard, and by such a method bearing olive trees cannot be produced in less than eighteen or twenty years, and then only by extreme care and watchfulness. In California the method of growing olive trees from small cuttings has for ten years been made a great success. Olive trees for orchard planting purposes used to cost $7 and $8 each. They can now be had by the thousands for ten and fifteen cents each.

A poor Pomona nurseryman named McLennon found by experimenting that olive trees could be propagated from cuttings by starting them in the winter months in boxes of sand in hothouses. That discovery is worth millions of dollars to California and the Southwest, but the discoverer has lately been working in a Pomona nursery at $1.50 a day. The cuttings that come by the hundreds from a full sized tree are about the size of toothpicks. The new method of propagating requires the most constant attention and much experience, but the plants are grown on such an enormous scale that the cost of each is very low. When the cuttings are rooted they are transferred, in the warmer months of spring, to the out of door nursery, where they become trees of three and four feet in height in twelve or eighteen months

The practical fruit grower plants the trees in his olive orchard forty feet apart, so that there will be ample room for the roots to spread over a large area and to get all the sustenance possible from the soil. The olive has almost a human gift of adaptation to environment. It flourishes in a temperature that falls to 14 degrees above zero, and in the inland valleys of California, where the thermometer reaches 120 degrees, it grows irrigated only by natural rainfall. It finds in the California foothills just such homelike surroundings as at its 4 000 feet level in Algeria and its Italian elevation of 3.200 feet. It will prosper in any friable soil rich in lime and potash, as are all the virgin lands of the crest. It also does well where its roots can penetrate easily a rocky, clay, sand, granite or volcanic formation, seeming to prefer an arid mountain soil, but not disdaining life in the black adobe near the coast.

The most popular olive in California is the mission. It is much smaller than the olive of commerce, that has long been known in the Eastern States, and there are many objections to it by the most recent olive growers, because the Eastern public, where the Californians are making their market, do not take to it. The mission is that brought here by the mission fathers. It has shown a ready adaptability to any soil in California, and is a prolific and steady producer. The olive nurseryman, however, say that the new varieties of the fruit that have been imported from Italy and southern France, will in time become the most prolific, and therefore the most generally grown varieties of the fruit in this State, but they cannot as yet be relied upon to produce paying crops every year. Special attention is now given to cultivating olives for oil alone or for keeping qualities in pickle; and here again there are a variety of opinions among horticulturists.

From the time the young olive trees are planted in the orchard it is seven years before they begin to bear profitable crops. At ten years of age each tree ought to produce, with good care and fair soil and moisture, four and five gallons of berries a year. There are some trees in the Pomona Valley that have borne six and seven gallons of olives when ten years old. As the trees grow older the weight of the crops increases, and there are several trees about the San Gabriel Mission that have each produced fifty gallons of olives in one year.—San Francisco Chronicle.

[FROM THE INDEPENDENT.]

APPENDICITIS.

By FREDERICK WIGGIN, M.D., Visiting Surgeon to the New York City Hospital (B.I.)

OF the inflammatory diseases which affect the abdomen and its viscera, the most frequent and important is the one known as appendicitis. In no other disease has a greater advance in treatment been made during the past decade than in this.

The change from a condition formerly considered wellnigh hopeless as soon as it was recognized, which was seldom, to one still grave and taxing the physician's powers to the utmost, but almost as certain to result in the patient's recovery under proper treatment, is due to a greater knowledge of the disease, to the physician's ability to make an earlier and more exact diagnosis, and, most important of all, to the improved and enlightened methods based on scientific investigations of modern surgical technic—the result obtained being one of the surgical triumphs of the century.

To American surgeons belongs the honor of having been the first to recognize and successfully treat this as well as other intra-abdominal diseases. The popular interest in everything pertaining to appendicitis has been so great that, before entering upon a detailed description of the methods by means of which these brilliant results have been achieved, a few words descriptive of the organ and the disease, its causation and diagnosis, will not be out of place.

In the right side of the abdominal cavity, a little below and to the right of the navel, the small intestine ends, and is united to a pouch-like dilatation which marks the beginning of the large intestine. This enlargement is known as the head of the colon; from its lower and under surface projects a rudimentary, worm-like dilatation, the free end terminating in a blunt point. It varies in length from one to nine inches, the average being about three, its internal diameter being about one-sixth of an inch. This tube is called the appendix vermiformis. It has, so far as is known, no function to perform, and is considered a useless and at times a dangerous organ. The inflammatory changes that take place at this point are known as appendicitis. This disease is most frequently encountered in males between the ages of fourteen and thirty.

Indigestible food and overloading the stomach favor its occurrence. Injuries, such as may be caused by blows or the lifting of heavy weights, may produce it; probably the most frequent occasion of the disease is the lodgment of fecal matter in the appendix. It is rarely caused, as was formerly supposed, by foreign bodies which are swallowed, such as seeds, fruit stones, pins or fish bones entering and perforating the organ.

One attack of this disease predisposes the patient to another, which rarely fails sooner or later to make its appearance and, if not treated, generally recurs again and again, the interval between attacks constantly growing shorter.

The disease makes itself manifest by its sudden onset, by the occurrence of colicky pain, by localized tenderness, when pressure is made on the right side of the abdomen, and by nausea accompanied by elevation of bodily temperature.

Unfortunately, at this time it can seldom be foretold whether the attack is to be a mild or a severe one.

The medical treatment is limited to rest in bed, cold applications to the abdomen and enemata to unload the large intestine. Opium should not be given in any form till a decision has been reached as to the nature of the disease. If the symptoms continue to increase in severity in spite of these measures, or the attack is a second one, it is usually deemed best to operate. It is in deciding this question that special experience counts for the most. In a grave case every hour that is lost decreases the chance for a successful outcome of the surgeon's work.

Given a decision that an operation is advisable, the question is at once asked, Will it be necessary to remove the patient to a hospital, or can the operation be performed at the patient's residence? A few years ago it was thought that a successful operation of this nature could only be done in a specially and expensively constructed room, also that many special appliances were indispensable; but as experience has increased and disinfection has given way to cleanliness, these accessories have gradually been dispensed with, and it is generally conceded that, though less convenient, an important operation can be as safely performed in a properly prepared room in a dwelling as in the most perfectly appointed city hospital. The services of a trained nurse will be needed, and one should be secured.

A room some distance from that occupied by the patient, and having preferably a north window, should be chosen. All the furniture, pictures, hangings and carpet should be removed and the room thoroughly swept and cleaned, the floor being well scrubbed. The ceiling, side walls and woodwork should now be wiped over with a solution of corrosive sublimate, the floor being liberally wet with the same fluid.

One large and two small new kitchen tables and several wooden-bottomed chairs will be needed. They should be scrubbed and washed with corrosive sublimate solution, as should all necessary utensils before being placed in the prepared room. The following objects will be needed: One new blanket; one new pillow; several clean sheets; several large china or granite ware wash bowls; several large four-quart china pitchers; one new four-quart fountain syringe; three hot-water bags; two alcohol lamps; one gas or kerosene stove; one new asparagus boiler; one steam sterilizer, Arnold's); two slop jars; several meat platters; several pie plates; one new tin quart cup; one new long-handled dipper; one new wash boiler; one new wooden bath thermometer; two rubber sheets.

The water used during the operation is strained and placed in the new boiler, and sterilized by boiling for one hour; a teaspoonful of table salt, which has been sterilized by heat, is added to each pint as it is transferred to the pitchers, some of which should now be filled and set aside after being covered with a clean towel, so that the water may cool, that remaining in the boiler being kept warm for use at the operation. These preparations can, when necessary, be made in a few hours.

No food or drink should be given the patient for several hours prior to the time fixed on for the operation, who is further prepared by being given a warm bath, special attention being paid to the abdominal surface, which should be well scrubbed with green soap and then lathered and carefully shaved; a compress wet in a corrosive sublimate solution is finally applied over the site of the proposed incision, and is left in place till the patient reaches the operating table.

The gowns, rubber aprons, sheets, towels and materials used for dressing the wound should next be placed in the sterilizer and subjected to the steam for three-quarters of an hour.

The asparagus boiler, having been partly filled with sterilized water, to which a little green soap has been added, and the solution having come to the boiling point, the instruments which have been placed on the tray are lowered into it, and are rendered sterile by boiling for about fifteen minutes, when they are taken out and placed on the dishes, which are filled with hot saline solution.

The silkworm gut and the sponges may be sterilized by boiling in saline solution; but they are usually purchased prepared and ready for use, stored in hermetically sealed glass tubes and bottles which are opened as needed and the contents placed in hot saline solution for a few minutes. The fountain syringe is filled with hot saline solution, completing the arrangements for the operation. The anæsthetic, which in this country is usually ether, is then administered to the patient, while still in bed, who, as soon as the drug takes effect, is transferred to the operating room.

While this is doing, the surgeon and those who are to assist him prepare their hands and arms, which should be made bare to above the elbow, by scrubbing them thoroughly with hot sterilized water and green soap, using sterilized nail brushes, particular attention being given to the finger nails. The hands are finally washed and soaked for a few minutes in ninety-five per cent. alcohol. The rubber aprons and gowns are donned, and the surgeons are ready to begin their work.

The chest and lower portion of the patient's body, who has been placed on the operating table, are protected by the rubber sheets over which are placed sterilized towels, as little of the body being exposed as possible. The pad which was previously put on the patient's abdomen is removed, the skin is thoroughly washed with alcohol, and the operator begins by making an incision in the skin over the site of the appendix. It varies in each case and is usually from three to six inches in length. The other tissues having been cut through or separated, the peritoneum comes into view. It is the closed sack which surrounds the organs. Before this is opened all bleeding points are secured, and the wound is cleansed by washing it with saline solution. A portion of the membrane is picked up by the aid of forceps and a nick is made in it. The surgeon, after rinsing his hand in saline solution, introduces a finger into the cavity, and, using it for a guide, enlarges the opening with scissors. The offending organ is now felt for, and in those cases which are operated on early, there is usually little difficulty in locating it and bringing it into view. It is seized and held up by a pair of forceps, and while so held an incision is made through its outer or peritoneal coat below the attachment of the organ to the head of the colon, a ligature of fine silk is passed around the remaining tissues and tied, and the appendix is cut off, the resulting stump is disinfected with a drop of pure carbolic acid, and the peritoneal coat is drawn forward and closed by a few stitches. The bowel is returned into the abdominal cavity, which is washed out and left full of the hot saline solution. The different layers of the external wound are approximated by sutures which may be either of silkworm gut or kangaroo tendon. The wound is dusted over with a white, odorless powder (acetanilid), and flexible collodion is painted over the surface, sealing the wound hermetically. Over this is placed a layer of sterilized cotton, which is kept in place by strips of adhesive plaster. A binder is then passed around the patient's body and fastened, completing the dressing and the operation, which generally occupies about forty minutes. The patient is at once returned to bed and surrounded by hot water bags. If the anæsthetic (ether) has been carefully administered by means of a closed inhaler and the operation has not been unduly prolonged, the patient will regain consciousness rapidly, will suffer but little from shock, and have little or no nausea.

If all the details heretofore described have been faithfully and carefully carried out by every one who has taken part in either the preparation of the room, the patient, the sterilization of instruments, ligature, suture and dressing material, and the operator and his assistants have succeeded in rendering their hands, finger nails and arms surgically clean, the object of these labors will undoubtedly have been accomplished, that of excluding from the wound the various micro-organisms which infest all dust and the superficial layers of the skin, especially that which grows under and around the edges of the finger nails; if these organisms, I may repeat, have been successfully excluded from the wound, little will remain for the surgeon to do. The trained nurse must largely do what follows.

A successful operation is seldom followed by pain, and anodynes are rarely needed. For the first twenty hours little is desired or allowed the patient in the way of nourishment except water, which may be given at intervals. After this period of time has elapsed, peptonized milk, egg albumen or beef juice are administered, a small quantity of one or other being given at short intervals, which are gradually increased, as is the quantity of food given. For the first thirty-six hours there is usually a slight rise of bodily temperature, which has little significance, and which promptly subsides. If no secondary rise of temperature takes place—fever due to septic infection appearing usually on the third day—and the cathartic given on the fourth day has acted, the patient is allowed ordinary diet on the fifth day. On the seventh day the dressings are changed, and the wound will be found to have healed. The sutures are removed; if of silkworm gut, a fresh application of collodion is made to protect the resulting scar, which in six months may be scarcely visible.

The patient must rest quietly in bed till the eighteenth day, and is then allowed to get up, and soon resumes his or her usual habits of life.

Such are the simple but laborious details by means of which difficult and important operations are to-day safely performed, with an almost insignificant mortality, which a few years ago were seldom undertaken, and when attempted generally resulted in failure. The responsibility of the modern surgeon is great, for he well knows that the successful outcome of his work, barring complications, entirely depends, in most cases, on the faithfulness with which the details just described have been carried out, and not on the good condition of the patient's blood, which was formerly supposed to be bad, and the cause of wound infection, if it occurred, as it frequently did, and was the solace of the surgeon when he failed in his work from this cause thirty years ago.

ON OYSTERS AND TYPHOID.*

OUR motives in undertaking this investigation have been:

1. Purely scientific—the elucidation of the life conditions of the oyster, both under normal and abnormal environment.

2. Economic or technological—to trace the causes and effects of diseased conditions, with the view of determining what basis exists for the recent "oyster and typhoid" scare, (a) in the interests of the oyster fisheries and (b) in the interests of the general public.

A. The objects, in detail, we had in view in entering on the investigation were as follows:

1. To determine the conditions of life and health and growth of the oyster by keeping samples in sea waters of different composition—e. g., it is a matter of discussion among practical ostreiculturists as to what specific gravity or salinity of water and what amount of lime are best for the due proportionate growth of both shell and body.

2. To determine the effect of feeding oysters on various substances—both natural food, such as Diatoms, and artificial food, such as oatmeal. Here, again, there is a want of agreement at present as to the benefit or otherwise of feeding oysters in captivity.

3. To determine the effect of adding various impurities to the water in which the oysters are grown, and

*An experimental inquiry into the effect upon the oyster of various external conditions, including pathogenic organisms. A paper presented before section D at the Ipswich meeting of the British Association, by R. W. Boyce, Professor of Pathology in University College, Liverpool; and W. A. Herdman, Professor of Zoology in University College, Liverpool.

especially the effect of sewage in various quantities. It is notorious that oysters are frequently grown or laid down for fattening purposes in water which is more or less contaminated by sewage, but it is still an open question as to the resulting effect upon the oyster.

4. To determine whether oysters not infected with a pathogenic organism, but grown under insanitary conditions, have a deleterious effect when used as food by animals.

5. To determine the effect upon the oyster of infection with typhoid, both naturally—i. e., by feeding with sewage water containing typhoid stools and artificially—i. e., by feeding on a culture in broth of the typhoid organism.

6. To determine the fate of the typhoid bacillus in the oyster—whether it is confined to the alimentary canal, and whether it increases in any special part or gives rise to any diseased conditions; how long it remains in the alimentary canal; whether it remains and grows in the pallial cavity, on the surface of the mantle and branchial folds; and whether it produces any altered condition of these parts that can be recognized by the eye on opening the oyster.

7. To determine whether an oyster can free its alimentary canal and pallial cavity from the typhoid organism when placed in a stream of clean sea water; and, if so, how long would be required, under average conditions, to render infected oysters practically harmless.

B. The methods which we employed in attaining these objects were as follows:

1. Observations upon oysters laid down in the sea, at Port Erin:

(a) Sunk in five fathoms in the bay, in pure water.

(b) Deposited in shore pool, but in clean water.

(c) Laid down in three different spots in more or less close proximity to the main drain pipe, opening into the sea below low water mark.

These were to ascertain differences of fattening, condition, mortality, and the acquisition of deleterious properties as the result of sewage contamination.

2. Observations upon oysters, subjected to various abnormal conditions in the laboratory.*

(a) A series of oysters placed in sea water and allowed to stagnate, in order to determine effect of nonaeration.

(b) Similar series in water kept periodically aerated.

(c) A series placed in sea water to which a given quantity of fresh (tap) water was added daily, to determine effect of reduction of salinity.

(d) A series of oysters weighed approximately, and fed upon the following substances, viz.:

(1) Oatmeal.
(2) Flour.
(3) Sugar.
(4) Broth.
(5) Living Protophyta (Diatoms, Desmids, Algæ).
(6) Living Protozoa (Infusoria, etc.)
(7) Earth.

In this series of experiments the oysters were fed every morning and the water aerated, but not changed (evaporation was compensated for by the addition of a little tap water as required). The oysters were weighed from time to time, and observations made upon the apparently harmful or beneficial effects of the above methods of treatment.

(e) A series of oysters placed in sea water to which was added daily

(1) Healthy fæcal matter.
(2) Typhoid fæcal matter.
(3) Pure cultivations of the typhoid bacillus.

The oysters were carfully examined to determine their condition, with special reference to condition of branchia, alimentary canal, adductor muscle, and viscera generally. The contents of the rectum, as well as the water in the pallial cavity, were subjected to bacteriological analysis to determine the number of micro-organisms present, as well as the identity of the typhoid or other pathogenic organisms.

C. The following is a summary of the results obtained so far:

We consider that these results are based upon tentative experiments, and serve only to indicate further any definite lines of research. They must not be regarded as conclusive. We feel strongly that all the experiments must be repeated and extended in several directions.

Our experiments demonstrate:

I. The beneficial effects of aeration

(a) By the addition of air only;

(b) By change of water;

pointing to the conclusion that the laying down of oysters in localities where there is a good change of water, by tidal current or otherwise, should be beneficial.

II. The diverse results obtained by feeding upon various substances, among which the following may be noted. The exceedingly harmful action of sugar, which caused the oysters to decrease in weight and die; while the other substances detailed above enabled them to maintain their weight or increase. The oysters thrive best upon the living protophyta and protozoa. Those fed upon oatmeal and flour after a time sickened and eventually died.

III. The deleterious effects of stagnation, owing to the collection of excretory products, growth of micro-organisms, and formation of scums upon the surface of the water.

IV. The toleration of sewage, etc. It was found that oysters could, up to a certain point, render clear sewage-contaminated water, and that they could live for a prolonged period in water rendered completely opaque by the addition of fæcal matter; that the fæcal matter obtained from cases of typhoid was more inimical than that obtained from healthy subjects; and that there was considerable toleration to peptonized broth.

V. The infection of the oyster by the micro-organisms. The results of the bacteriological examination of the water of the pallial cavity of the oyster, and of the contents of the rectum, showed that in the cases of those laid down in the open water of the bay the colonies present were especially small in number, while in those laid down in proximity to the drain pipe the number was enormous (e. g., 17.000, as against 10 in the former case). It was found that more organisms were present in the pallial cavity than in the rectum. In the case of the oysters grown in water infected with the Bacillus typhosus, it was found that there was no apparent increase of the organisms, but that they could be identified in cultures taken from the water of the pallial cavity and rectum fourteen days after infection.

It is found that the typhoid bacillus will not flourish in clean sea water, and our experiments seem to show so far that it decreases in numbers in its passage along the alimentary canal of the oyster. It would seem possible, therefore, that by methods similar to those employed in the "Bassins de dégorgement" of the French ostreiculturist, where the oysters are carefully subjected to a natural process of cleaning, oysters previously contaminated with sewage could be freed of pathogenic organisms or their products without spoiling the oyster for the market.

It need scarcely be pointed out that if it becomes possible thus to cleanse infected or suspected oysters by a simple mode of treatment which will render them innocuous, a great boon will have been conferred upon both the oyster trade and the oyster consuming public.

We desire to acknowledge the kind help of Mr. W. I. Beaumont in making some of the observations at Port Erin, and of Mr. Andrew Scott at Liverpool.

* The oysters were kept in basins in cool rooms of constant temperature, shaded from the sun, both at the Port Erin Biological Station and also in the pathological and zoological laboratories at University College, Liverpool.

ANTISEPTICS IN OINTMENTS.

A PAPER has recently been published by Dr. E. Breslauer under the rather lengthy title of "The Antiseptic Action of Ointments, with Special Reference to the Influence of Composition on Disinfectant Value." The subject, however, is an important one, for as Koch has demonstrated the fact that carbolic oil possesses no disinfectant properties, it is well that we should know how antiseptics behave in the form of ointments, a point concerning which there has been no definite information up to the present. Dr. Breslauer has undertaken to solve this problem by a series of very practical and extremely exact experiments. He describes the methods he has employed, among which Spirig's cover-glass method is the principal, and then gives the results of his experiments. He attaches less importance to testing the strength of the antiseptics themselves than to their behavior when mixed with different ointment bases. For his investigations he selected oil, vaseline, fat, lanoline, anhydrous lanoline and cold cream, and used Staphylococcus pyogenes aureus and Bacillus prodigiosus. It was demonstrated that when, for instance, carbolic acid was used, carbolized vaseline was superior to carbolic oil, carbolized fat to carbolized vaseline, carbolized anhydrous lanoline to carbolized fat, and that superior to all was carbolized lanoline and carbolized cold cream. Similar results were obtained when corrosive sublimate, resorcin, silver nitrate, boric acid and salicylic acid were substituted for carbolic acid: the combinations with lanoline and with cold cream always proved the most active ointments. Moreover, several ointments much employed in medical practice were tested as to their bactericidal action, such as unguentum zinci, unguentum hydrargyri, and unguentum hydrargyri ammoniati. The two mercurial ointments exhibited a high degree of antiseptic action, the others none. It was also determined that other ointment vehicles less extensively employed, such as ung. simplex, œsypus, adeps lanæ, epidermin and ung. glycerini, are all inferior to lanoline and cold cream in antiseptic power.

The value of this investigation is increased by the additional experiments made by the author with the different ointment constituents upon animals. These corroborated the conclusions already arrived at. Koch's experiments referred to above are little known in this country, and it may be useful, therefore, to put on record some entirely independent results obtained by Mr. William Duncan, Edinburgh, who communicated the notes to us as far back as 1891, and to which we made brief reference at that time. The observations referred to were commenced with the view of finding out why text books state that carbolic oil is almost, if not quite, inert. Two reasons are assigned for this: either that the oil loses acid by evaporation or that chemical interaction takes place between the acid and the oil. The first explanation is groundless, for a 10 per cent. carbolic oil was found to have lost nothing at the end of six months. The second explanation is also incorrect, for solutions of the acid in almond oil of various ages were found to have undergone no chemical change. The acid can be extracted from the oil in an unaltered condition, and in practically the same quantity as put in. The common explanations of inactivity having thus been disproved, experiments with bacteria were commenced, and these conclusively showed that when water was excluded germicidal action was almost nil.

Before destruction of micro-organisms can take place contact is necessary, and this contact must be hindered, if not absolutely prevented, by the non-miscibility of oil with the discharges usually found in wounds. The same complaints have not been made about glycerinum acid. carbolic., which mixes readily with pus. Indeed, it seems strange that substances usually regarded as antidotes to this poison should ever have been used as vehicles for its administration. If its germicidal properties are to any extent the result of its power of coagulating albumen, then everything that interferes with this property by lowering or preventing it must of necessity render it more or less useless as an antiseptic agent.

These results are strikingly corroborated by Dr. Breslauer, who finds that the most reliable ointment bases are those containing water—viz., cold cream and lanoline. We call attention to these matters, because there are few departments in pharmacy which have been so much neglected as ointments. We still adhere tenaciously to tradition in these matters. Dr. Breslauer mentions zinc ointment as exhibiting no antiseptic action. If he had gone further, he might have found that this ointment under certain conditions becomes the most dangerous possible application to open sores. There is no ointment so liable to become bad, and occasionally cases of gangrene are met with in hospitals which are traceable to the use of zinc ointment. What this is due to is not exactly known, but it only happens with rancid ointment, and it is highly probable that it is due to the presence of the Staphylococcus pyogenes aureus.—Chemist and Druggist.

THE HERMITE PROCESS OF DEODORIZING SEWAGE AT IPSWICH.*

By J. NAPIER, F.C.S., F.I.C.

THE treatment of sewage for the purpose of preventing putrefaction is a subject which has occupied the minds of chemical and sanitary engineers for many years, and numerous methods of dealing with it have been devised and brought before this and other societies, each claiming to perform its work in a more perfect manner than its predecessor. Those methods, with only one or two exceptions, treat the sewage at a point between the last inlet into the main sewer and the outfall, usually at the outfall, and as far away from the town as it is possible to put it. Those systems of dealing with sewage at the outfall do not give the town from whence it came any sanitary benefit. They do not prevent sewer gas accumulating in the sewers and escaping into the air from manholes or ventilating shafts and becoming an annoyance and nuisance to the inhabitants. The object of those systems of treating sewage, then, is to purify the sewage sufficiently to prevent the pollution of a waterway or river, and without in any way being of the slightest benefit to the health of the town. With the Hermite process the sewage is treated at the other end of the sewers—i. e., at the beginning—deodorized there, so that flowing through a town the sewers give off no offensive smells, and the putrefactive changes which take place in sewage have been arrested. There is no need for ventilating shafts, and if the manholes are perforated there is no offensive smell given off; on the contrary, there is a faint chlorous or bleach smell.

The principle of this process is passing current of electricity through sea water, or if sea water is not handy, a solution of magnesium and sodium chlorides; a portion of these chlorides is converted into hypochlorite, a substance which disinfects, deodorizes, and bleaches similar to the active ingredient of bleaching powder—calcium hypochlorite. The change from chloride to hypochlorite takes place almost entirely with the magnesium salt-yielding magnesium hypochlorite ($MgCl_2O_2$). It is found, however, that in the electrolyzers and tanks a white deposit takes place, consisting of magnesium oxide combined with water—viz., magnesium hydrate—showing that the magnesium hypochlorite has decomposed, forming magnesic hydrate, which precipitates, leaving hypochlorous acid in solution. The action may take place as follows: $MgCl_2O_2 + 2H_2O = MgH_2O_2 + 2HClO$. This is called the Hermite solution. The amount of oxidizing power is expressed by the quantity of available chlorine in grammes per liter—the usual working strengths being from five to one gramme per liter of solution. When sewage is mixed with about 5 per cent. of the solution the offensive smell is instantaneously destroyed, and the decomposition arrested for about six days, long enough under ordinary circumstances for the sewage to be well out to sea.

This electrolyzed, or Hermite, solution has been subjected to many experiments, and numerous criticisms have been made upon it as to its power of rendering sewage sterile—as, for instance, the Lancet Commission who report favorably on the system from experiments made at Worthing; also by Sir Henry Roscoe and Mr. J. Lunt, B.Sc., the results of which were read before the Society of Chemical Industry, and described in that Society's Journal in March last. Sir Henry found that a 0·8 gramme solution practically sterilized the liquid portion of the sewage when used in sufficient quantity, and that the solid matters were unaffected; and that "the Hermite fluid even of 0·25 strength acts as an excellent deodorizer." This is a point taken up by the Ipswich Corporation. They say if we can have the sewage deodorized and its decomposition arrested for from three to six days, the sewage will be well out to sea and the nuisances of offensive smells in the town will be entirely done away with. Sir Henry also made experiments as to the stability of the electrolyzed solution, and he found that a 0·5 gramme solution lost 90 per cent. of its strength in twenty-four hours, a 0·75 gramme solution being more stable, losing 34 per cent. and a 1 gramme solution 10 per cent. in the same time. This is very interesting and important; but as regards the working of the system in Ipswich, it is not necessary to take this into consideration, because the moment the electrolyzed solution is made it is carried direct into the sewer within two minutes after its production. We have in Ipswich been electrolyzing sea-water for three months and treating the sewage. The sewage committee directed me to report on its working, so I made daily tests and inspections for about two months.

The strength of solution varied from half a gramme to one gramme, according to the flow of sea water through the electrolyzers, the quantity of available chlorine made being fairly constant, and the average being 1·04 gramme per ampere hour. As to the effects of this solution on the sewage I have no figures to give you, but can give a general idea of its deodorizing powers. We have two rivers, viz., the Gipping, a canal which extends to and is navigable as far as Stowmarket, about ten miles inland. The last or bottom lock is situated near Handford Bridge. Below this point the river is tidal, and is called the Orwell. In close proximity to the town we have the dock, covering about 33 acres, along each side of which the principal merchants of the town have their works or premises for shipment. The Gipping has an arm which leads from the locks to where there was once an oil mill—now the steam laundry—driven by a water wheel, and from this there was a waterway through the town as far as Fison's Mills at Stoke Bridge. When Ipswich was sewered, about sixteen or seventeen years ago, according to the suggestions of Mr. P. Bruff, and carried out by our present borough surveyor Mr. E. Buckham, the main or intercepting sewer was laid in this waterway, from Portman Road, as far as it went, and continues to the outfall.

The difficulties in the way of sewering and treating sewage in Ipswich may be explained in Mr. Buckham's own words: "To dispose of the sewage of

* Paper read at the meeting of the British Association at Ipswich.

Ipswich, either by irrigation or by intermittent filtration, would be attended with considerable expense. The town is divided by the river Orwell, and, as is frequently the case with towns so situated, the longitudinal falls are very slight, while the lateral falls are very great. The fall from the one end of the sewer to the other is only 8 ft., so the flow is not very rapid, while, taking a section of the town laterally, there is plenty of fall, and, in consequence, a rapid current into the main sewer. On this account the experiments with the electrolyzed solution were made on the main sewer, and at present the solution is running in the sewer at Handford Road in close proximity to the beginning of the main sewer. The result is complete deodorization of the sewage throughout a long length of the sewer. For a distance of 700 yards free chlorine can be instantly detected by test papers, and for a distance of 1760 yards the chlorous smell is perceptible, although insufficient to have any action on the test paper. Not only does the main sewer receive the arterials, but it receives the drainage of several slaughter houses and breweries containing much organic matter. Below the point indicated—Church Street, St. Clements—there is such a great increase in the quantity of sewage that the results were doubtful. On several occasions, however, samples taken from the outfall were without smell and kept two days, and in one instance it kept four days. If the amount of electrolyzed solution or its strength could have been increased, the sewage at the outfall would certainly have been completely deodorized, if not sterilized. This is a point which I hope the sewage committee will aim at, and when putting the plant permanently into the new buildings that they will have sufficient electrolyzers and power to produce enough fluid to deodorize all the sewage of Ipswich, and have some to spare for flushing or washing infected areas. I noticed in some of my early morning inspections, when the flow of sewage was at its minimum, that the deposit in the sewer was bleached nearly white by the action of the electrolyzed solution. This process has not been going long enough to allow me to obtain any statistics as to the health of the borough or the death rate, compared with previous years and with other towns; but this I am sure of, that where the sewage has been treated no complaints have been received as to offensive smells. I am confident that any town that adopts this process, which will boldly erect plant to produce more than enough of the electrolyzed solution, will be spending money well, and in time will feel the benefit by increased health of the inhabitants, and also by having a lower death rate. This is what I have suggested Ipswich should do, so that in a year or two, when we are able to make comparisons, we will find a reduction in the death rate. Such a result will make the process cheap at any price."

ATOMIC WEIGHTS.

By F. W. CLARKE.

I SUBMIT a table of atomic weights revised to January 1, 1894. O = 16 is still retained as the base of the system; but I hope that in another year it will be practicable to return to H = 1.

Name.	Atomic weight.	Name.	Atomic weight.
Aluminum	27·	Neodymium	140·5
Antimony	120·	Nickel	58·7
Arsenic	75·	Nitrogen	14·03
Barium	137·43	Osmium	190·8
Bismuth	208·	Oxygen	16·
Boron	11·	Palladium	106·5
Bromine	79·95	Phosphorus	31·
Cadmium	112·	Platinum	195·
Cæsium	132·9	Potassium	39·11
Calcium	40·	Praseodymium	143·5
Carbon	12·	Rhodium	103·
Cerium	140·2	Rubidium	85·5
Chlorine	35·45	Ruthenium	101·6
Chromium	52·1	Samarium	150·
Cobalt	59·5	Scandium	44·
Columbium	94·	Selenium	79·
Copper	63·6	Silicon	28·4
Erbium	166·3	Silver	107·92
Fluorine	19·	Sodium	23·05
Gadolinium	156·1	Strontium	87·66
Gallium	69·	Sulphur	32·06
Germanium	72·3	Tantalum	182·6
Glucinum	9·	Tellurium	125·
Gold	197·3	Terbium	160·
Hydrogen	1·008	Thallium	204·18
Indium	113·7	Thorium	232·6
Iodine	126·85	Thulium	170·7
Iridium	193·1	Tin	119·
Iron	56·	Titanium	48·
Lanthanum	138·2	Tungsten	184·9
Lead	206·95	Uranium	239·6
Lithium	7·02	Vanadium	51·4
Magnesium	24·3	Ytterbium	173·
Manganese	55·	Yttrium	89·1
Mercury	200·	Zinc	65·3
Molybdenum	96·	Zirconium	90·6

FORMIC ALDEHYD; ITS DETECTION IN MILK, AND VALUE AS A PRESERVATIVE.

By R. T. THOMSON, F.I.C.

THE commercial form of this article, known as formalin, may be obtained for chemical purposes as a liquid guaranteed to contain 40 per cent. of real formic aldehyd; but a much weaker solution appears to be sold to some extent to milk dealers for adding as a preservative to milk, in place of boric acid or borax.

As formic aldehyd requires to be added to milk only in very small quantity, it is evident that its detection, and especially its estimation, presents unusual difficulties. I have recently made experiments with the object of proving the presence of this substance in milks, and have found that a modification of the well known reaction with ammonia-nitrate of silver gives a good indication of its presence. To apply the test 100 cc. of the milk are carefully distilled until (say) 20 cc. of distillate comes over; this is transferred to a stoppered tube, and about 5 drops of ammonia silver nitrate added. (This solution is prepared by dissolving 1 grm. of silver nitrate crystals in 30 cc. of distilled water, adding dilute ammonia till the precipitate at first formed is redissolved, and then making up to 50 cc. with water.) The mixture of the milk distillate and the silver solution is now allowed to stand for several hours in a dark place (as much as 12 to 18 hours may be necessary if very little formic aldehyd is present), when, if formic aldehyd is present, a strong black color or deposit will be produced. A light brown color should be disregarded; but, so far as my experience goes, the production of a decided black under these circumstances is not only brought out by formic aldehyd, but possibly by other aldehyds also. The usual method of heating with the silver solution in order to obtain a silver mirror is of no value with weak solutions of formic aldehyd. It was found that genuine milks from various sources, when tested by the method described, gave no reaction whatever, even when the distillate was left mixed with the silver solution for twenty-four hours; or at most gave a slight brown tinge. When as little as 2 grains of the 40 per cent. formalin was added to 1 gallon of milk (which before addition gave no reaction with this process), the distillate from 100 cc. gave a decided black color, or deposit intense enough to render the mixture quite opaque. As 2 grains per gallon is a quantity of formalin which would be of little value in the preservation of milk, it is evident that this method of testing is quite delicate enough for the purpose. It ought to noted that, if a milk contains about 2 grains of formalin per gallon, the 20 cc. distillate from 100 cc. of the milk appears to contain all the formic aldehyd that will distill over, and distillates after that give practically no reaction. A milk containing 7 or 8 grains per gallon of the preservative may require the distillation to be carried on till 30 or 40 cc. are collected, before it ceases to show a reaction with the silver solution; but in all cases the reaction can be got by distilling over the 20 cc., or indeed 10 cc.

An attempt was made to determine the proportion of formic aldehyd in a milk by comparing the depth of color obtained from its distillate with that given by a standard solution of the aldehyd. This was not successful, owing to the fact that the reduced silver often forms a deposit on the side of the tube, while the liquid is comparatively colorless. In this connection it was noticed that the distillate from a milk containing a certain proportion of formic aldehyd did not give nearly so great a depth of black color as the same amount simply added to water, and then tested with the silver solution. This would point to the conclusion that there is a loss of formic aldehyd, probably by decomposition, during the distillation, and this also would add to the incorrectness of a determination.

I should have mentioned that care should be taken not to add excess of ammonia to the ammonia silver nitrate solution used in the test, as if much excess of ammonia is present no reaction will be obtained, even in presence of formic aldehyd.

It has been mentioned by other chemists that formalin may be used as a preservative for milk samples; and I have found by experiment that samples, to which has been added 4 or 5 drops of the 40 per cent. formic aldehyd per 100 cc. of the milk, have kept in good condition for six weeks, and given the same results, on analysis after that period, as when analyzed before the preservative was added. As formic aldehyd is in such an available form for addition to milk samples, without in any way interfering with the accuracy of the results of analysis, it should prove useful to analysts in the preservation of samples for reference. As in the case of other preservatives, its use for milk supplies should not be recommended until its harmlessness were fully proved.

I have also made a few experiments with the view of comparing the value of formic aldehyd as a preservative with such well known articles as boric acid, salicylic acid, and benzoic acid. For this purpose measured quantities of the same milk, to which the various preservatives were added, were kept in stoppered bottles under the same conditions as nearly as possible, and the condition of each examined from time to time, one sample of the milk free from preservative being also kept along with these for comparison. In the following table will be found the results of the observations made:

TABLE SHOWING THE PRESERVING POWER, AS REGARDS MILK, OF CERTAIN PRESERVATIVES.

Preservative employed.	Milk after standing 6 days.	Milk after standing 7 days.	Milk after standing 8 days. Lactic acid per cent.	Milk after standing 11 days. Lactic acid per cent.
None	Sour	Sour, curdled	0·68	0·71
Forty per cent. formic aldehyd (8¾ grs. per gallon.)	Sweet	Sweet	0·12	0·48
Forty per cent. formic aldehyd (17½ grs. per gallon.)	Sweet	Sweet	0·10	0·14
Forty per cent. formic aldehyd (35 grs. per gallon.)	Sweet	Sweet	0·07	0·10
Boric acid (35 grs. per gallon.)	Turned	Sour, curdled	0·42	0·52
Boric acid and borax in equivalent quantities (= 35 grains boric acid.)	Sweet	Sweet	0·10	0·32
Salicylic acid (35 grs. per gallon.)	Sweet	Sweet	0·10	0·28
Benzoic acid (17½ grs. per gallon.)	Slightly turned	Sour	0·45	0·52

It is apparent from these results that 8¾ grains of the 40 per cent. solution of formalin are quite as effective in preserving milk as four times that amount of boric acid (at least when used as a mixture of boric acid and borax), and the same proportion of salicylic acid, while the preserving power of benzoic acid is very low compared with what might be expected from statements made in text books. It also seems peculiar that boric acid alone is much inferior to a mixture of boric acid and borax so made up that each of these substances contributes equal to 17·5 grains of crystallized boric acid per gallon of milk. The proportion of 35 grains of boric acid per gallon of milk was adopted because that is about the usual amount I have found in samples to which that preservative has been added.

It may quite reasonably be argued that the results above are not sufficient in number to allow of any decided opinion as to the exact comparative value of the preservative tested; but, taking into consideration the concordant results of the three tests with formic aldehyd, I have no hesitation in claiming that these are approximately the values of the respective preservatives for milk at least.

I am continuing my experiments with formic aldehyd, in order to find a method of determining the amount present in a milk, as well as its value in preserving milk samples, and also further and extended experiments on the value of the various preservatives.

City Analysts' Laboratory, Glasgow.

—Chemical News.

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